*Dissertation*

*On*

# RETROSPECTIVE STUDY OF FUNCTIONAL OUTCOME OF UNCEMENTED TOTAL HIP ARTHROPLASTY

**Submitted to**

**THE TAMIL NADU DR. M.G.R. MEDICAL UNIVERSITY**

**CHENNAI.**

## M.S. BRANCH II

## ORTHOPAEDIC SURGERY


**DEPARTMENT OF ORTHOPAEDIC SURGERY**

**KILPAUK MEDICAL COLLEGE**

**CHENNAI – 600 010.**


**FEBRUARY 2006**

# ACKNOWLEDGEMENT

I am deeply indebted to my beloved and kindhearted Professor **Dr.K.J.MATHIAZHAGAN, B.Sc., M.S. (Ortho), D.Ortho.,** Professor and HOD of Department of Orthopaedic Surgery, Kilpauk Medical College Hospital, Chennai- 600 010 for his invaluable help, guidance and encouragement in preparing this study.

I wish to thank **Dr.R. SAMUEL GNANAM,** for guiding me to complete this study. I am also very thankful to **Dr.K.RAJU, Dr.V.SINGARAVADIVELU, Dr.S.VEERAKUMAR, Dr. M.S.ABULKASIM,** Assistant Professors in the Department who have been a constant source of inspiration and encouragement.

My heartful thanks and appreciation to all my fellow post graduates for their constant help and encouragement in completing this study.

Last but not the least, I express my sincere gratitude to all my patients without whom this study would not have been accomplished.

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# CERTIFICATE

This is to certify that **"RETROSPECTIVE STUDY OF FUNCTIONAL OUTCOME OF UNCEMENTED TOTAL HIP ARTHROPLASTY"** is a bonafide work done by **Dr. P. KOSALA RAMAN**, post graduate student, Department of Orthopaedic Surgery, Kilpauk Medical College, Chennai 10 under my guidance and supervision in fulfillment of regulations of The Tamilnadu Dr. M.G.R. Medical University for the award of M.S. Degree Branch II, (Orthopaedic Surgery) during the academic period from March 2004 to February 2006.

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# INTRODUCTION

Uncemented total hip arthroplasty is a time tested remarkable surgical procedure that provides mobility, stability as well as better quality of life for thousands of patients, especially young patients throughout the world.

Total hip arthroplasty can be either be cemented or uncemented. The goals of total hip arthroplasty are simple; to relieve pain, to provide motion while maintaining stability and to correct the deformity.

From the days of Charnley until the mid 1980s cemented total hip arthroplasty was the ideal mode of joint replacement. But it was noted later that bone cement is the weakest link between the implant and bone. Subsequently failures of cemented total hip arthroplasty were seen due to various reasons like microfractures of cement mantle under torsional loading, loosening due to particulate induced osteolysis, bone loss with difficulty in future revision. Further the direct life threatening adverse effects of bone cement such as sudden hypotension, myocardial depression, fat, air and pulmonary embolism, local bone necrosis are noted complications.

The above mentioned adverse effects of bone cement led to the popularity of uncemented total hip arthroplasty. Here porous and hydroxy apatite coated components are used. This creates a

biological interface called bone ingrowth (osteo integration). Instead of fatiguing and failing of bone cement, this type of fixation continually grows stronger, remodelled and becomes more permanent. The three criteria for bone ingrowth are pores > 40mm in diameter, absence of micromotion, intimacy of porous surface with bone.

The uncemented total hip arthroplasty has its own drawbacks like inadequate initial fixation, excessive wear, periprosthetic bone loss due to particle induced lysis.

Thus uncemented total hip arthroplasty today has become, the main mode of hip replacement especially in young patients. Hence at the department of orthopaedic surgery at KMCH, a retrospective study was conducted to evaluate the functional outcome of uncemented total hip arthroplasty.

# AIM OF THE STUDY

The aim of the study was to analyse retrospectively the radiological, clinical and functional outcome of uncemented total hip arthroplasty.

# REVIEW OF LITERATURE

I Surgical Anatomy of the hip joint.

II Biomechanics of hip

II Design & Selection of implant

IV Fixation of cementless implants

V Indications and contraindications

VI Preoperative evaluation of Patients and Radiographs

VII Surgical Procedure

VIII Post OP Protocol

IX Complications of total hip arthroplasty

# I. SURGICAL ANATOMY OF HIP JOINT

Hip joint is a Ball and Socket variety of synovial joint with multi axial movements.

## ARTICULAR SURFACES

The head of femur articulates with the acetabulum to form the hip joint. The head of femur forms more than half a sphere and is covered with hyaline cartilage except at Fovea capitis. The acetabulum has a horse shoe shaped, lunate surface, acetabular notch, and acetabular fossa. Only lunate surface is articular and is covered with articular cartilage.

Hip joint has a high degree of both stability as well as mobility due to various factors like,

1. The depth of acetabulum with a narrow mouth made by acetabular labrum.
2. Tension and strength of ligaments.
3. Strength of the surrounding muscles.
4. Length and obliquity of neck of femur.
5. The atmospheric pressure.

## LIGAMENTS

### 1. Fibrous capsule

It is attached proximally to the acetabular labrum, transverse acetabular ligament and to the bone above and behind the acetabulum. Distally it is attached to intertrochanteric line in front and 1 cm medial to intertrochanteric crest behind. Anterosuperiorly the capsule is thick and firmly attached because this is the weight bearing portion. Postero inferiorly the capsule is thin and loosely attached. The capsule is made up of two types of fibres, the outer longitudinal and inner circular (Zona orbicularis).The longitudinal fibres are reflected to form the retinacula which contains blood vessels supplying the head and neck of femur.

### Synovial membrane

It lines the fibrous capsule, intra capsular portion of neck of femur, acetabular labrum, transverse acetabular ligament and the round ligament of head of femur.

### 2. Ileofemoral ligament (ligament of Bigelow)

One of the strongest ligament in the body. It is triangular in shape. Apex is attached to anterior inferior iliac spine and base is attached to inter trochanteric line.

**3. Pubofemoral ligament**

It supports the joint inferomedially and it is also triangular in shape.

**4. Ischiofemoral ligament**

It is weak and covers the joint posteriorly.

**5. Ligament of Head of femur (Round liagement or ligamentum teres)**

It is a flat triangular ligament. The apex is attached to fovea capitis and base to transverse ligament and margins of acetabular notch. It transmits arteries to head of femur from the acetabular branches of obturator and medial circumflex femoral arteries.

**6. Acetabular labrum (cotyloid ligament)**

It is a fibrocartilaginous rim attached to margins of acetabulum.

**7. Transverse ligament of Acetabulum**

It is a part of acetabular labrum which bridges the acetabular notch.

## RELATIONS OF HIP JOINT

a. Anteriorly – Pectineus covered by femoral vein, iliopsoas with femoral nerve, straight head of rectus femoris.
b. Posteriorly – Quadratus femoris with the ascending branch of medial circumflex femoral artery, obturator internus with 2 gemelli, separate the sciatic nerve from nerve to quadratus femoris and piriformis.
c. Superiorly – Reflected head of rectus femoris covered by gluteus minimus.
d. Inferiorly – Pectineus and obturator externus.

### Blood supply

By obturator, medial and lateral circumflex femoral, superior and inferior gluteal arteries.

### Nerve supply

Femoral nerve through nerve to rectus femoris, anterior division of obturator nerve, accessory obturator N., N. to quadratus femoris and superior gluteal nerve.

### Movements

Flexion and Extension – Around transverse Axis

Flexion by iliopsoas

Extension by Gluteal maximus and hamstrings

Abduction and Adduction : Around AP aris

Adduction by adductor longus, brevis, magnus

Abduction by Gluteus medius and minimus.

Medial and lateral rotation – Around vertical axis

Medial rotation by tensor fascia lata, Gluteus medius and minimus

Lateral rotation by two obturator, 2 gemelli and quadratus femoris.

## II. BIOMECHANICS OF HIP

The biomechanics of total hip arthroplasty is different from those of plates and nails used in bone fixation because they provide only partial support and used only until the bone union. In total hip arthroplasty the components must withstand many years of cyclical loading atleast 3 to 5 times the body weight and at times subjected to 10-12 times the body weight.

**Forces acting on the Hip**

The lever arm of body weight extends from the body's centre of gravity to the centre of femoral head. The abductor musculature acting on a lever arm extending from the lateral aspect of greater trochanter to the centre of femoral head must exert an equal

moment to hold the pelvis level when in a one legged stance. Since the ratio of the length of the lever arm of the body weight to that of the abductor musculature is about 2.5:1, the force of the abductor muscles must approximate 2.5 times the body weight to maintain the pelvis level when standing on one leg.

Crown in Shield et al. calculated that Peak contact forces across the hip joint normally range from 3.5 to 5 times the body weight. Therefore the excess body weight and increased physical activity tend to loosen, bend or break the femoral stem.

The forces on the joint act not only in the coronal plane, but because the body's centre of gravity (in the midline anterior to $S_2$) is posterior to the axis of the joint, they also act in the sagittal plane to bend the stem posteriorly. The forces acting in this direction are increased when the loaded hip is flexed as when arising from the chair, ascending and descending stair case. During stair climbing and straight leg raising, the resultant force cause posterior deflection or retroversion of the femoral stem.

**Rotational stability**

Increasing the width of proximal stem to better fill the metaphysis increases the torsional stability of the stem when it is implanted without cement.

Freeman et al found that rotational stability can be improved by retention of longer segment of femoral neck. Modifications of distal stem such as rounded, rectangular cross section resist rotation. Longitudinal cutting flutes and extensive porous coating improves rotational stability.

**Centralisation of Head**

An integral part of Charnley's concept of total hip arthroplasty was to shorten the lever arm of body weight by deepening the acetabulum (centralization of femoral head) and to lengthen the lever arm of abductor mechanism by reattaching the osteotomized greater trochanter laterally. Thus the moment produced by the body weight is decreased.

The abductor lever arm may be shortened in arthritis when a part or all of the head is lost or the neck is shortened. It is also shortened when the trochanter is located posteriorly as in external rotation deformities and in DDH. In an arthritic hip the ratio of the lever arm of the body weight with that of the abductors may be as high as 4:1. The length of the two lever arms can be surgically changed to ratio of 1:1. This reduces the total load on the hip by as much as 30%.

The principle of centralization preserves as much subchondral bone in the pelvis as possible and to deepen the

acetabulum only as much as necessary to obtain bony coverage for the cup.

The location of the centre of rotation of the hip also affects the forces generated about the implant. The joint reaction force was lower when the hip centre was placed in an anatomical location compared to a superolateral or posterior position. Isolated superior placement without lateralisation produces small increase in stresses across the periacetabular bone. This is of importance in the treatment of DDH and in revision surgeries, when the superior bone stalk is deficient. Higher incidence of radiolucencies and migration of component in seen in patients with protrusion, DDH and in revision when the hip centre was placed in a non anatomical location.

**Neck length and offsets**

The normal centre of rotation of femoral head is determined by three factors :

(1) Vertical height (vertical offset) – of femoral head is measured as the distance to the centre of femoral head from a fixed point such as the lesser trochanter. Restoring this distance is essential to correct leg length discrepancy.

(2) Medial or Horizontal offset or simply offset is the distance from the centre of femoral head to a line through the axis of the distal part of the stem. Inadequate offset shortens

the lever arm of abductors resulting in increased joint reaction force, limp, bony impingement leading to dislocation. The excessive offset leads to stem fracture or loosening. Offset is primarily the function of the stem design.

Vertical height and offset both increases as the neck is lengthened and proper reconstruction of both features is the goal when selecting the length of femoral neck.

(3) Version – refers to orientation of neck in reference to the coronal plane. Normal femur has 10-15° of anteversion of neck in relation to the coronal plane. Retroversion can result in posterior dislocation especially when posterior approach has been used. Similarly excessive anteversion of the neck can result in anterior dislocation.

## III. DESIGN AND SELECTION OF IMPLANTS

Basically we have used 4 parameters in deciding if an uncemented or cemented stem is to be implanted. Each parameter is allotted a point scale. The total points for the patient concerned, produce a value which can be used to determine appropriate implantation. The parameters are as follows :

**1. Sex**

The loss of bone substance which begins around the age of 40 years is higher among females. Later it is increased by hormonal changes which is typical of menopause.

**2. Age**

Before the age of 60 years an uncemented prosthesis is indicated in all cases. This will allow easy removal of the implant if revision be required later. For patients over the age of 70 years, cemented stem is usually indicated.

**3. Singh's Index**

It is based on the changes in the trabecular pattern of the upperend of femur which is used as an index of osteoporosis.

Stage 7 denotes normal femur

Stage 6 & 5 reveal slight osteoporosis

Stage 4 & 3 indicate advanced osteoporsis and uncemented stem is indicated only in young male patients.

Stage 2 & 1 are absolute contraindication for an uncemented stem.

**4. Morphological cortical index**

**It is based on 2 variables**

a) Morphology – shape of femur – femora can be divided into 3 categories morphologically into trumpet shape, cylindrical and dysplastic. Due to its form the trumpet shaped femur is ideal for cementless implantation.

b) Morphological cortical index – it consists of ratio of 2 sizes which can be measured on a standard AP X-ray of the femur.

$$MCI = \frac{CD}{AB}$$

CD – Distance between the outer limit of lateral and medial cortical layers measured at the greatest prominence of lesser trochanter and vertically to the longitudinal axis of femur.

AB – Diameter of the meduallary canal 7 cm distal to CD line.

**EVALUATION OF POINTS**

| **Sex** | **Points** | **Age** | **Points** | **Singh's Index** | **Points** |
|---|---|---|---|---|---|
| Male | 0 | <50 | 0 | 7 | 0 |
| Female | 1 | 50-60 | 1 | 6-5 | 1 |
| | | 61-70 | 2 | 4-3 | 2 |

| | | | | | |
|---|---|---|---|---|---|
| | | > 70 years | 4 | 2-1 | 4 |

| MCI | Points | Total | Points |
|---|---|---|---|
| > 3 | 0 | 0-4 | Uncemented |
| 3-2.7 | 1 | 5 | Possible |
| 2.6 – 2.3 | 2 | ≥ 6 | Cemented |
| < 2.3 | 4 | | |

**DESCRIPTION OF IMPLANTS :-**

**Femoral component :-**

In all cases CLS stem is used. Since its launch on the international market in 1985, after having been implanted for the first time in 1983 the CLS stem designed by Prof. L. Spotorno has proven itself as one of the most successful uncemented stem. The stem is made up of a high strength Ti6 Al TNb forged alloy (PROTASUL-100) and has a rough corundum – blasted finish. The prosthesis is used with a modular head of Co Cr Mo alloy (PROTOSUL-1) or $Al_2O_3$ Ceramic (Biolox) with necks of various length.

The three dimensional "press fit" provides immediate mechanical stability. The frontal and sagittal planes of the prosthesis are conical and the surfaces are provided with parallel, longitudinally arranged conical ribs. The stem's rotational stability

is achieved by means of ribs which are wedged into proximal cancellous bone.

Proximal fixation with absence of implant bone contact in the distal part of the stem ensures proximal load transmission and thus prevents distal stress shielding. With highly osteophilic nature of titanium a safe long term fixation of implant is achieved as the bone will grow directly onto the implant surface thus providing osteo integration.

**Acetabular component :**

The two types of acetabular components that are used in our study are the standard cup and the st. Nabor cup.

**Standard cup :**

It is a modular acetabular implant with a titanium shell and a polyethylene insert with or without a metasul inlay. Cementless anchorage is by press fit and subsequent osteointegration.

Primary fixation is achieved by forcing the titanium shell into the undersized reamed acetabulum and by sharp edged elevations which prevent rotation and tilting. Additional transacetabular screw fixation was used in 6 cases. The major advantages of standard cups are simple surgical technique and good primary stability and titanium surface suitable for osteo-integration. The components of standard cup are :-

**Titanium shell :**

The standard cup consists of a hemispherical titaniumshell and polyethylene insert.

**Screw sockets :**

The proximal half of the shell has openings for counter sunk cancellous bone screws which are inserted towards the sacro iliac joint. The screw socket permit positioning of screws at any angle with in a 30° range. The usual position of screw holes are 11'O clock, 1'O clock and 3'O clock positions.

**Pyramids**

There are no screw openings in the distal half of the shell but there is sharp edged pyramid like elevations which penetrate the cancellous bone during impaction. They also prevent rotation and tilting.

**Press fit**

The high primary stability of standard cup is due to the fact that it has a greater diameter than the previously reamed acetabulum. This ensures press fit fixation of the implant. It is available in 2mm steps with diameters ranging from 44 to 62 mm.

**The central hole**

The threaded hole serves the mounting on the setting instrument. The pin on the convex pole of the polyethylene insert fits into this hole.

**Anti dislocation Rim**

One section of the rim of the polyetheplene insert has a raised edge to prevent dislocation. This can be inserted in 30° steps in any desired position.

**Metasul**

For young patients with long life expectancy polyethylene insert with metal on metal articulation is available.

## IV . FIXATION OF CEMENTLESS IMPLANTS

The success of uncemented total hip arthroplasty depends on biological fixation. Stable immediate (primary) fixation is a requirement for success such that secondary fixation via bone growth can occur. The bone growth occurs due to the direct formation of woven bone without cartilaginous intermediary and there is lamellar bone remedelling around the implant that contributes to bone ingrowth.

Engh and Bobyn proposed a simple classification for implant fixation based on roentgenographic inspection. Fixation is classified as

1. **Fixation by bone ingrowth** is defined as an implant with no subsidence and minimal or no radioopaque line formation around the stem. Cortical hypertrophy may be present at the distal end of porous surface and "spot welds" may be evident between the stem and periosteum. Varying degrees of proximal stress shielding are present.
2. **Fixation by stable fibrous ingrowth** : Here no progressive migration of the implant occurs but an extensive radioopaque lines form around the stem. These lines surround the stem in a parallel fashion and are separated from the stem by a radiolucent zone upto 1mm wide. The femoral cortex shows no signs of local hypertrophy suggesting uniform load carrying function.
3. **An unstable implant** : is defined as one with either progressive subsidence or migration within the canal and is atleast partially surrounded by divergent radioopaque lines that are more widely separated from the stem at its extremities. Increased cortical density typically occurs beneath the collar and at the end of the stem indicating lack of uniform stress transfer.

# V. INDICATIONS AND CONTRA INDICATIONS

The most important indication of total hip arthroplasty is pain in the hip. The various indications are :

**1) Arthritis**

- Rheumatoid
- Ankylosing spondylitis

*Degenerative joint disease (OA)*

- Primary
- Secondary due to :
  - Slipped capital femoral epiphysis
  - DDH/CDH
  - Leggcalve's perthe's disease
  - Paget's disease
  - Fracture of Acetabulum
  - Haemophilia

**2) Avascular necrosis**

Post fracture / dislocation

Slipped capital femoral epiphysis

Haemoglobinopathies (sickle cell disease)

Steroid induced

Alcoholism

Caisson's disease

**3) Pyogenic arthritis / osteomyelitis**

Haematogenous

Postoperative

Tuberculous

**4) Failed Reconstruction**

Osteotomy

Cup arthroplasty

Girdle – stone arthroplasty

Resurfacing arthroplasty.

5) Bone tumours of proximal femur / acetabulum

6) Hereditary disorders

Achondro plasia

**CONTRA INDICATIONS**

**Absolute**

Active infection of hip joint

Unstable medical illness

**Relative**

Neuropathic joint

Absent or insufficient abductor mechanism

A prerequisite for the use of standard cup is good acetabular bone quality providing press fit fixation. Further the acetabulum must be sufficiently deep in order to achieve complete cranial osseous coverage. Large sub chondral cyst in the acetabulum is not a contraindication because the cyst can be removed and filled with autogenous cancellous bone chips.

Insufficient acetabular bone stock is a contra indication. To ensure sufficient osseous support after insertion ¾th of the acetabular rim must be still present.

## VI. PRE OPERATIVE EVALUATION OF THE PATIENT AND RADIOGRAPHS

- General condition of patient is assessed for anaemia, COPD, DM, HTN, Occult infections, thromboembolism, any anti coagulant drug intake.
- Aspirin and other antiinflammatory drugs are discontinued 7-10 days before surgery.
- Pyogenic skin lesions are eradicated.
- In urethral obstruction transurethral resection of Prostate (TURP) done before elective arthroplasty.
- Any purulent discharge from the hip should be aspirated and pus culture sensitivity done.
- Soft tissues about the hip inspected for any inflammation or scarring.

- Strength of the abductors is determined by the trendelenberg test.
- Any limb length discrepancy and fixed deformity is assessed.
- When both hip and knee are arthritic usually the hip should be operated first.
- True hip joint pain usually is perceived in the groin sometimes in the anterior thigh, in the knee.
- Status of the hip is rated preoperatively by Harris Hip Scoring.
- Total hip arthroplasty entiles blood loss upto 1000-1500 ml during the perioperative period.
- Banking of autologous blood prior to surgery reduce the risk of transfusion reactions and infections from homologous transfusion.
- Deposition of 3 units of blood for a primary procedure and 4 to 5 units of blood for revision procedure is required.
- In bilateral cases usually the most painful hip is operated first and then wait for 3 months or longer for the other hip.

**Pre operative assessment of X-rays :**

- AP view of pelvis showing proximal femur and lateral view of hip with proximal femur are the minimum views

required. In special cases X-Rays of spine and knee are required.

- X-ray pelvis is reviewed specifically for the adequacy of bone stock for the fixation of acetabular component, amount of reaming required, need for bone grafting and whether protrusion or osteo phyte may make dislocation of the hip difficult.
- With old fracture dislocation obturator and iliac oblique views are taken to detect any defect in posterior wall.
- The width of medullary canal is noted as it may be narrow in young patient, in DDH and dwarfs. In these cases a femoral component with a straight stem or a small stem may be required.
- In pagets disease, old fracture of femoral shaft or congenital anamolies the presence of anterior bowing makes reaming of the medullary canal difficult. If excessive bowing or rotational deformity is present femoral osteotomy may be required.

## VII. SURGICAL PROCEDURE

**Preoperative planning :**

The objectives of preoperative planning are to determine the correct stem size, optimal stem positioning in the medullary canal, correct size of acetabular cup and to maintain equal leg length. The

planning is done by using the plastic overlay templates, suppiled by the sulzer company.

The templating aims in detection of the type of implant, neck length required and to determine the femoral offset.

**Prophylactic antibiotics**

The antibiotics are administered in the operative room 15-30 min before the skin incision. Peak serum and tissue concentrations is achieved 20 min of parenteral dosing. A third generation cephalosporins like cefotaxime 1 gm is usually given preoperatively. No evidence suggest that administration of antibiotics for more than 48 hrs is advantageous. The infection rate decreases from 11% to 1% with the use of prophylactic antibiotics.

**Surgical approach**

In our series Hardinge direct lateral approach is used in 21 patients and Moore's posterior approach in the remaining 2 patients. The choice of approach is based on surgeon's preference. The original Charnley technique used anterolateral approach with osteotomy of greater trochanter and anterior dislocation of hip. Trochanteric osteotomy increases lever arm of the abductors. This approach is used much less commonly now as a result of problems related to reattachment of the greater trochanter.

**Hardinge lateral approach**

It is carried out with patient supine or in the lateral position. Here osteotomy of greater trochanter is avoided. A posteriorly directed Lazy-J incision is made centered over the greater trochanter. Fascia lata in line with skin incision is divided. Retract tensor fascia lata anteriorly and gluteus maximus posteriorly exposing origin of vastus lateralis and insertion of gluteus medius.

Incise the tendon of gluteus medius, obliquely at the junction of ant 1/3 and post 2/3 of the muscle. Distally carry the incision anteriorly in line with the fibres of vastus lateralis down to bone along the anterolateral surface of femur. Care is taken not to dissect gluteus medius 5 cm proximally to avoid injury to superior gluteal nerve.Then gluteus medius was retracted to expose the gluteus minimus.

Elevate the tendinous insertion of gluteus minimus and vastus lateralis muscle. Abduction of thigh exposes the anterior capsule which is incised. The muscle splitting incision through gluteus medius and minimus allows anterior dislocation of hip and affords excellent acetabular exposure. The residual abductor weakness and limp may occur due to direct injury to the superior gluteal nerve.

The Dall variation of this approach involves removal of anterior portion of abductors with a thin wafer of bone from the anterior edge of greater trochanter to facilitate their later repair.

# VIII. POSTOPERATIVE PROTOCOL

The IV antibiotics are continued for 10 days till suture removal. The drain is removed on the second post operative day. In the immediate post op period the hip is positioned in approximately 15° of abduction by using a triangular pillow to prevent postoperative dislocation. Preoperatively the patient is stressed about do's and don'ts like not to squat, not to sit on the floor cross legged, to avoid strenuous activity and to maintain ideal body weight.

In the first post operative day bed exercises and limited mobilisation begin. Deep breathing, ankle pumps, quadriceps and gluteal isometrics, gentle rotational exercises begun. Straight leg rising though beneficial after TKR is not helpful after total hip arthroplasty, groin pain often results and this also places unnecessary rotational strain on the femoral component.

On the first or second postoperative day patient can sit on the side of the bed or in a chair in a semirecumbant position.

Gait training usually can begun on the 1st post-operative day. Mostly a walker for balance and stability can be used. The amount of weight bearing depends on the means of fixation of components, the presence of structural bone grafts, stress risers in the femur and trochanteric osteotomy. With cementless implants limited weight bearing for 6-12 weeks is recommended.

On the 3rd post operative day patient is encouraged to walk with 2 crutches. Weight bearing should not exceed 1/3 of body weight. Discharge under normal circumstances is between 10th and 12th postoperative day. 1st followup examination is 7 weeks after surgery with gradual increase in weight bearing in the subsequent 7 weeks, still employing 2 crutches. Then rapid reduction of the use of cane is required. Hip extension exercises are encouraged especially if there is a preexisting flexion deformity. For toilet purposes the patient can be advised to use western toilet or modified stool with basin. Sexual activity can be resumed in the supine position.

Between 3 to 6 months postoperatively nearly 50% of muscle strength is regained. Patients with sedentary occupation can return to work after 6 to 8 weeks. At 3 months they can do limited lifting and bending.

## IX. COMPLICATIONS OF TOTAL HIP ARTHROPLASTY

The various complications are as follows :

**1. Nerve Injury** : Sciatic, femoral, peroneal and obturator nerves may be injured by direct surgical trauma, traction, pressure from retractors and extremity positioning, limb lengthening and thermal or pressure injury from bone cement. Revision surgery carry increased risk of injury to the Sciatic nerve because the nerve

may be caught in the scar tissue. The placement of transacetabular screws can also damage sciatic or obturator nerve.

**2. Vascular injury** : commonly seen during revision surgery. Removal of soft tissues from the inferior wall of acetabulum can injure the obturator vessels. The penetration of medial wall of acetabulum can injure the common iliac artery or superficial iliac vein. The transacetabular screws can injure the external iliac vessels in the anterosuperior quadrant and obturator vessels in the antero-inferior quadrant.

3. Haemorrhage and Haematoma formation may occur in patients with bleeding disorders, recent salicylate, steroid, anti-coagulant therapies, liver disorder, pagets disease and Gaucher's disease.

4. Bladder injuries and UTI-For patients with BPH transurethral resection is advised before Total hip arthroplasty.

5. Limb length discrepancies – most commonly lengthening occurs due to insufficient resection of femoral neck or using prosthesis with longer neck or from changing the centre of rotation.

6. Dislocation and subluxation is due to the following risk factors:-

a) Previous hip surgery or revision Total hip arthroplasty

b) Posterior surgical approach

c) Faulty positioning of the components

d) Impingement of femur on pelvis or residual osteophytes.

e) Inadequate soft tissue tension.

f) Insufficient or weak abductor muscles

g) Avulsion or nonunion of greater trochanter

h) Non compliance or extremes of position in the post operative period.

7. Heterotropic ossification – It is commonly seen in men with ankylosing spondylitis, forestier disease (diffuse idiopathic skeletal hyperostosis), hypertrophic osteoarthritis. The Brooker classification of Heterotropic ossification is

I Islands of bone in soft tissues

II Bone spurs from proximal femur or pelvis with atleast 1cm between them.

III Bone spurs with less than 1cm between opposing bony surfaces.

IV Ankylosis

8. Intraoperative femoral fractures

It is classified as :-

Type – 1 : Include area of lesser trochanter and calcar.

Treatment – Cerclage wiring.

Type – II : Past Lesser trochanter to a point 4 cm proximal to the tip of prosthesis.

Managed with cerclage.

Type – III : Below 4 cm marking to the tip of the stem.

Managed with circumferential wires, plates, long stem prosthesis and bone grafting.

**Post operative femoral fractures**

The vancouver classification is :-

Type A – Involves the trochanteric area – lesser or greater trochanter

Type B – At the tip of the stem or just distal to it. Most common type.

B1 - Stem well fixed

B2 - Stem is loose

B3 - Stem is loose and proximal femur is deficient

Type C - Well below the tip of the stem with no stem loosening.

**Intraoperative or post operative acetabular fractures**

9. Thrombo embolism – It is the most common cause of death in the first three months following Total hip arthroplasty.

10. Trochanteric nonunion and migration.

11. Loosening – This is a serious longterm complication. This can be either septic or aseptic caused by particulate debris or polyethylene wear.

12. Infection – It is a catastrophic complication which is painful, disabling and deep seated infection requires removal of the implant.

13. Osteolysis – This is mainly attributed to cement and is called cement disease. But osteolysis can also occur in cementless implants due to stress shielding, and as a host response to particulate debris.

14. Stem failure or fracture.

15. Gastrointestinal bleeding, myocardial infarction, congestive cardiac failure, fat embolism are the other complications in the postoperative period.

# MATERIALS AND METHODS

In our institution 23 cases of uncemented total hip replacement surgeries were done in 21 patients (bilateral in two patients) for various clinical indications. The female to male ratio was 1:2. The followup period range from 1½ to 4½ years. The followup outcome was evaluated clinically, radiologially and functional outcome by modified Harris Hipscore. This study was conducted between February 2001 to July 2005.

The various indications in our study are :

**TABLE 1**

| Sl.No. | Diagnosis | No. of Cases | % of Cases |
|---|---|---|---|
| 1. | Chronic arthritis | 12 | 52.1% |
| 2. | AVN of head of femur | 5 | 21.75 |
| 3. | Fracture Neck of femur with non union | 3 | 13% |
| 4. | Fracture neck of femur with implant failure | 2 | 8.6% |
| 5. | Neglected posterior dislocation of hip | 1 | 4.3% |

**TABLE 2**

The age distribution in our study was

| Sl.No. | Age in years | No. of Cases | % of Cases |
|---|---|---|---|
| 1. | 20-30 years | 10 | 43.5% |
| 2. | 31-40 years | 7 | 30.4% |
| 3. | 41-50 years | 5 | 21.7% |
| 4. | 51-60 years | 1 | 4.3% |

**TABLE 3**

Sex Distribution in our study was

| Sl.No. | Sex | No. of Cases | % of Cases |
|---|---|---|---|
| 1. | Male | 16 | 69.6% |
| 2. | Female | 7 | 30.4% |

**TABLE 4**

Side distribution in our study was

| Sl.No. | Side | No. of Cases | % of Cases |
|---|---|---|---|
| 1. | Right Side | 11 | 47.8% |
| 2. | Left side | 12 | 52.5% |

Appropriate preoperative planning was done and correct acetabular and femoral component was selected. The acetabular component that was used is sulzer standard cup in 19 cases (82.6%)

and St. Nabor Cup in 4 cases (17.4%). The femoral component that was used is cementless spotorno stem (CLS stem) in all cases.

The surgical approach used was the preference of the operative surgeon and Hardinge direct lateral approach was used in 21 cases (91.3%) and Moore's posterior approach was used in 2 cases (8.7%).

A standard protocol was used in the post operative period. Followup visits are made at 3 month, 6 month, 1 year and periodically thereafter. Routine X-rays are taken at 1-2 year intervals and compared with previous films for signs of loosening, migration, wear and implant failure.

**Post Operative Radiological Assessment**

The femoral component is assessed by following parameters :

1. Restoration of centre of rotation of hip compared to normal side by using Moss's Template.

2. Optimal fixation of femoral component is assessed by optimal contact of the middle third of the stem with both the medial and lateral endosteal disphyseal cortices over a distance of about 5 cm (occupy 80% of cross-section of the medullary canal).

3. Neutral position of the tip of the stem without any varus o r valgus angulation.

4. Tip of greater trochanter corresponds to the centre of head.

5. Optimum level of lesser trochanter on both sides for any limb length discrepancies.

6. Correct seating of collar of stem on the calcar of the femoral neck.

7. Restoration of offset (both medial or vertical as compared to normal side).

8. Femoral Neck Orientation to vertical offset. In the varus hip the vertical offset is smaller than the medial offset and the centre of head lies below the level of tip of the greater trochanter. In the valgus hip the vertical offset is larger than the medial offset and centre of head lies above the level of tip of greater trochanter.

9. Zonal Analysis by Gruen et al for loosening

   The femoral stem is divided into 7 zones and each zone is evaluated for bony apposition, radiopaque lines and radiolucency.

10. Bent stem is assessed by the angle made between a line through the centre of head and neck and another line drawn parallel to the lateral surface of the distal 2/3 of stem.

11. EBRA – FCA method of measurement of migration of femoral component :-

The femoral component was assessed by using Einzel – Bild – Roentgen Analyse. This method has the specificity of 100% and sensitivity of 78% compared with Roentgen Stereophoto grammetric analysis (RSA) for the detection of migration of over 1mm of femoral component from the standard radiographs. This is accurate enough to assess the stability of the prosthesis within a limited period. Early migration of prosthetic stems and cups is reported to predict later failure. This method provides information regarding subsidence, the medial and the lateral distance between the prosthesis and the bone margin.

There is a choice of four different reference line (a, b, c, d) for the measurement of migration.

a - Ti p of greater trochanter to stem shoulder

b - Tip of greater trochanter to centre of head

c - Tip of lesser trochanter to stem shoulder

d - Tip of lesser trochanter to centre of head.

Anova and Tukey testing confirmed that reference line between the tip of greater trochanter and stem shoulder give the

best accuracy with 95 percentile of 0.9 mm of migration. CAD experimental study clearly indicated that lesser trochanter to stem shoulder was the worst and that tip of the greater trochanter to stem shoulder was the best landmark for the measurement of subsidence.

Malchav et al. shown that measurement of stem migration on conventional radiograph varied from 4mm to 10mm depending en the choice of landmark.

**Acetabular component :**

It is assessed by the following parameters :-

1. Correct size of the cup and optimal seating of the cup without any polar gaps (Hemispherical acetabular component in wide contact with subchondral bone).
2. Correct inclination of the cup at 45° at the level of tear drop. Excessive inclination more than 45° leads to superior dislocation with adduction. Horizontal inclination of cup leads to early impingement in flexion and posterior dislocation.
3. Degree of anteversion – The average anteversion of the cup is 15° ± 10°. The version can be determined by the relative position of the anterior and posterior halves of the circumferential wire in the cup. Superimposition of the two halves of the wire indicate little or no anteversion.

4. Degree of polyethylene wear – It is measured by the linear distance of penetration of femoral head into polyethylene. It is assessed by superolateral migration of head of more than 2.5 mm.
5. The relative position of the transacetabular screws.

   The acetabulum is divided into 4 quadrants namely anterosuperior, antero inferior, postero superior, postero inferior. Screws in the antero superior quadrant can injure the external iliac artery and vein. In the anterior inferior quadrant they may injure, the obturator vessels and nerves Screws in the postero superior and postero inferior quadrants do not emerge within the pelvis but may pass into the sciatic notch and endanger the Sciatic nerve and Superior gluteal vessels. However the drill bit and screw threads can be palpated in the sciatic notch so that injury to these structures can be avoided. The postero superior quadrant is the safest zone and antero superior quadrant must be avoided.

6. The acetabular component loosening in three zones as described by DeLee and charnley.
7. Any reinforcement of the acetabulum with cages, rings and impaction grafting.

8. Protrusion of the cup – The Roentgeno-graphic hall mark of protrusion is the medial migration of the cup beyond the ilio ischial line (Kohler's line).

**Radiologically patients were classified into**

Group I - No radiological evidence of loosening (Osteo lysis, migration).

Group II - Radiological evidence of loosening is present, but the patient is asymptomatic.

Group III - Radiological evidence of loosening is present, and the patient is symptomatic.

**Assessment of functional outcome :**

It is assessed based on modified Harris Hip Score – It has the following components :

1. Pain – (44 Points Maximum)
2. Gait (walking maximum distance ) (33 points maximum)
3. Functional Activity (14 points maximum)
4. Absence of deformity (4 points maximum)
5. Range of motion (5 points maximum)
6. Total – 100 points.

The Harris Hip score is graded as follows :

Score < 70 – Poor
70-79 – fair
80 – 90 – good
90-100 – Excellent

# OBSERVATIONS AND RESULTS

In our study majority of the patients (52%) had chronic arthritis of hip. 21.7% of patients had avascular necrosis of head of femur.

13% of cases had fracture neck of femur with nonunion.

8.6% of cases had fracture neck of femur treated with cancellous screw fixation with subsequent implant failure.

4.3% of patients had neglected posterior dislocation of hip.

One patient had bilateral Rheumatoid arthritis for whom bilateral uncemented Total hip arthroplasty was done at an interval of 1 month. Similarly one patient had bilateral AVN of head of femur for whom bilateral uncemented Total hip arthroplasty was done at an interval of 2 weeks. All the 21 patients were crippled by severe pain that markedly limited their ADL. Two patients with Ankylosing spondylitis were operated on one side only and indomethacin was given postoperatively to prevent heterotropic ossification.

The surgical approach used was the preference of the operative surgeon and Hardinge's direct lateral approach was used in 21 cases (91.3%) and Moore's posterior approach was used in 2 cases (87%).

The acetabular component that was used was the sulzer standard cup in 19 cases (82.6%) and St. Nabor Cup in 4 cases (17.4%). The femoral component used was the cementless spotorno stem in all the cases.

All the patients were radiologically assessed for the following parameters :

**Femoral Component :**

- Prosthesis level above the lesser trochanter averages about 1.5 cm
- Optimal position of the prosthesis
  - Neutral - 18 (78.2%)
  - Valgus - 3 (13.0%)
  - Varus - 2 (8.8%)
- Canal fill of the stem inAP diameter averages about 80%.
- One femoral stem had canal fill less than 80% in the follow up period due to the aseptic loosening of the femoral component and subsequent stem subsidence.
- Intra operative femoral fractures was seen in 2 cases which was treated with cerclage.
- Aseptic loosening of the femoral stem in Gruen Zones 1 and 7 in one case.
- Majority of the stems had shown good osteo integration with bony ingrowth.

- There was no evidence of calcar resorption and radioopaque line formation in any case.

**Acetabular component :**

- Correct positioning with 45° inclination was seen in 19 cases (82.6%).
- The cup size was found to be larger in six cases (26%) and found to have over hanging margin beyond the superolateral rim in 5 cases (21.7%).
- Correct seating with intimate contact with subchondral bone without any polar gaps is seen in 21 cases (91.3%).
- Transacetabular screws to secure the cup firmly to the acetabulum was used in 6 cases (26.0%).
- Intraoperative acetabular fracture with impaction grafting was done in 1 patient.
- Acetabular loosening in Charnley and DeLee zones 2 & 3 was seen in 2 cases (8.6%).
- Protrusion of the acetabular cup into pelvis was seen in three cases (13.0%).
- Pelvic osteolysis due to transacetabular screws was seen in 3 cases.
- Hetero tropic ossification was seen in 3 cases (13%).
- Trochanteric osteolysis was seen in 1 patient.
- Post operative wound infection with subsequent loosening of the acetabular component was seen in one case.

The functional outcome was assessed based on modified Harris hip score which was graded as follows :

Score < 70 - Poor

70-79 - Fair

80-89 - Good

90-100 - Excellent

The range of preoperative Harris Hip score in our study is

30 – 45 - 9

46-60 - 14

The post operative Harris Hip Score during follow up study is

| | | |
|---|---|---|
| < 70 | Poor | 1 (4.3%) |
| 70-79 | Fair | 6 (26.2%) |
| 80-89 | Good | 11 (47.8%) |
| 90-100 | Excellent | 5 (21.7%) |

The poor result in one patient is due to the extensive femoral stem loosening, in the followup period. This patient being a driver has not complied with post operative instruction and has turned for followup with extensive femoral stem loosening and persistent worsening of pain.

The fair to poor results seen in 6 patients is due to the following factors :

- Ankylosing spondylitis affecting the opposite hip with restriction of ADL.
- Prosthetic dislocation that was subsequently reduced in one patinet.
- Acetabular revision following septic loosening of acetabular component.
- Intra operative acetabular fracture that was treated with impaction grafting.
- Intra operative femoral fracture that was treated with subsequent cerclage.
- Post operative protrusion of acetabular cup in three patients.
- Two patients had anterior thigh pain.
- Heterotropic ossification was seen in 3 patients, one patient had ankylosing spondylitis.
- Pelvic osteolysis was seen in 3 patients due to transacetabular screws.
- One patient had insignificant trochanteric osteolysis that has not affected the functional outcome.
- The average limb shortening is about 1cm in 6 cases and 2 cm in 1 case.

# RESULTS

- Uncemented Total hip arthroplasty has a definitive role in the management of chronic arthritis of young patients.
- In our study most of the patients belong to the age group of 20-30 years (43.5%).
- Males predominate in our study (69.6%).
- Chronic arthritis is the most common indication in our study.
- 2 Patients underwent bilateral Total hip arthroplasty one for bilateral AVN and the other for Rheumatoid arthritis.
- **Radiological Assessment :-**

**Femoral component :**

- Optimal position
  - Neutral - 18 (78.2%)
  - Valgus - 3 (13.0%)
  - Varus - 2 (8.8%)
- Majority of the stem had shown good osteo integration with bony ingrowth.

**Acetabular component :**

- Large cups in 6 cases (26%)
- Optimal inclination of 45° at the level of tear drop (82.6%).
- Over hanging margins beyond the superolateral rim (21.7%).
- Correct seating without any polar gaps (91.3%).

**Incidence of various complications in our study are :**

- Wound infection – 1 case (4.3%)
- Intra operative femoral fracture 2 cases (8.6%)
- Stem failure with aseptic loosening- 1 (4.3%).
- Intraoperative acetabular fracture with impaction grafting – 1 (4.3%).
- Acetabular loosening – (8.6%) – 2 cases.
- Protrusion of cup into pelvis – 13% (3)
- Heterotropic ossification – 13% (3)
- Acetabular revision – 1 (4.3%)
- Pelvic osteolysis – 3 (13 %)
- Trochanteric osteolysis – 1 (4.3%)
- Post operative prosthetic dislocation – 1 (4.3%)
- Anterior thigh pain 2 – (8.6%)
- Limb length discrepancy – 7 (30.4%)

# DISCUSSION

This retrospective study was conducted to analyse the radiological, clinical and functional outcome of uncemented Total hip arthroplasty done in younger individuals.

The results of the study are compared with the known similar studies given in the western literature.

**TABLE 5**

**The mean age group in our study was 36 years. The mean age group in other studies are :**

| | |
|---|---|
| Schramm et al.[51] | 47 years |
| Peter Aldinger et al (2003)[52] | 51 years |
| Siebold et al (2001)[54] | 55 years |
| Alexander et al (2002)[46] | 54 years |

**TABLE 6**

**The sex distribution in our study was males (69%) females (31%). In western studies the ratio was**

| | **Male** | **Female** |
|---|---|---|
| Schramm et al. [51] | 56% | 44% |
| Christoph Roder et al. 2003 [38] | 53% | 46% |
| Alexander et al.[46] | 61% | 38% |

**TABLE 7**

**The mean duration of followup in our study was 35 months.**

The maximum follow up was 53 months and minimum follow up was 17 months. In western studies the mean follow up is

| | |
|---|---|
| Schramm et al.[51] | 10.3 years |
| Peter Aldinger et al (2003)[52] | 12 years |
| Siebold et al (2001)[54] | 11.7 years |
| Alexander et al (2002)[46] | 2.8 years |

**TABLE 8**

**The most common indication in our study was chronic arthritis – 52%.**

The other indications are :

| | |
|---|---|
| AVN head of femur | 21.7% |
| Fracture neck of femur | 21.6% |
| Neglected posterior dislocation of hip | 4.3% |

**In Alexander et al (2002)[46]** study most common indication is chronic arthritis – 89%. The other indications are :-

| | |
|---|---|
| AVN head of femur | 8.7% |
| Fracture neck of femur | 0.5% |

No case of neglected posterior dislocation of hip is reported in this study.

The various radiological parameters in comparison with other studies are :

**Femoral stem alignment :**

Optimal position in our study :

**TABLE 9**

| | |
|---|---|
| Neutral | 78.2% |
| Valgus | 13% |
| Varus | 8.8% |

In R.B. BOURNE et al study (1998)[40] the alignment is

| | |
|---|---|
| Neutral | 95% |
| Valgus | 3% |
| Varus | 2% |

With respect to acetabular component large cups are used in 26% of patients. Over hanging margins beyond the superolateral rim was observed in 21.7% of cases. None of the above findings are reported in the western studies.

The immediate success of Total hip arthroplasty is determined by the ability of the patient to return to maximum

possible level of functional activity. Thus maximum points are given to pain and mobility of patients. Patients with chronic arthritis are incapacitated by pain and restricted motion and thus the relief of these two factors greatly determines the satisfactory outcome of the surgery.

Restoration of the biomechanics of the hip is important for the good outcome and longevity of the prosthesis. In all our cases we tried to restore the centre of rotation, limb length, medial and vertical offset.

We believed that maintaining considerable activity is important for bone remodelling and osteo integration. Only those activities that do not produce considerable joint load such as swimming, cycling and walking are recommended.

The activities that increase the joint load are cross legged sitting, squatting for toilet purposes and any strenuous physical activity. The reason for some of the failures in our study is the non compliance of the patient with respect to post operative counselling.

Pain following Total hip arthroplasty confined to thigh indicates loosening of femoral component and pain in the hip indicates loosening of acetabular component.

The functional outcome was assessed in our study by using the modified Harris Hip Score. In most of the western studies like

Schramm et al, Peter Aldinger et al, Siebold et al, Harris Hip Score was used to assess the functional outcome.

Knahr et al.[66](1998) considered Harris Hip Score as the best mean of objective evaluation of result of Total hip arthroplasty. Harris hip score is a preoperative and post operative scoring system designed to assess patients improvement, both objectively and subjectively.

We categorized our patients into 4 groups (Khahr et al.)

< 70 - Poor

70 – 79 - Fair

80 – 89 - Good

90 – 100 - Excellent

**TABLE 10**

The post operative Harris Hip Score at the end of follow up study is

| | | | |
|---|---|---|---|
| < 70 | Poor | (1) | 4.3% |
| 70-79 | Fair | (6) | 26.2% |
| 80-89 | Good | (11) | 47.8% |
| 90-100 | Excellent | (5) | 21.7% |

The follow up outcome Harris Hip Score in other studies are :

**Schramm et al. (1989)[51]**

Good or excellent - 84%

Fair - 14%

Poor - 2%

**Sharkey PR et al (1998)[20]**

Good or Excellent - 79%

Fair – or Poor - 20%

**TABLE 11**

The mean Harris Hip Score in our study was 82.9. The same in other studies are :-

| | |
|---|---|
| Schramm et al.[51] | 88 |
| Peter Aldinger et al.[52] | 84 |
| Siebold et al[54] | 94.3 |

The main reasons for the failure of CLS stem as indicated by various studies are :-

Peter Aldinger et al.[52] - High rate of Cup loosening and low Harris hip score .

Siebold et al. : wear is the main reason four osteolytic changes.

Aldinger et al[56] High rate of loosening and pain.

The incidence of various complications in comparison to other studies are :-

**TABLE 12**

**Stem Revision**

| | |
|---|---|
| Our study | 0% |
| Schramm et al.[51] | Nil |
| Peter Aldinger et al.[52] | 3.2% |
| Siebold et al.[54] | 4.4% |

**TABLE 13**

**Aseptic loosening of the femoral stem with Failure**

| | |
|---|---|
| Our Study | 4.3% |
| Siebold et al.[54] | 2.3% |
| Peter Aldinger et al.[52] | 1.9% |
| Aldinger et al.[56] | 3.9% |

**TABLE 14**

**Acetabular radiolucencies (loosening)**

| | |
|---|---|
| Our Study | 8.6% |
| Schramm et al.[51] | 5% |
| Alexander et al.[46] | 1% |

**TABLE 15**

**Acetabular revision**

| | |
|---|---|
| Our Study | 4.3% |
| Schramm et al.[51] | 2.8% |
| Sharkery PR et al.[20] | 2.5% |

**TABLE 16**

**Intraoperative femoral fracture**

| | |
|---|---|
| Our Study | 8.6% |
| R.B. Bourne et al.[40] | 5% |
| Herzwvrm et al.[37] | 4.1%-27.8% |

**TABLE 17**

**Periprosthetic femoral stem fracture**

| | |
|---|---|
| Our Study | 0% |
| Peter Aldinger et al.[52] | 0.6% |
| Guther D et al.[53] | 3% |
| Aldinger et al.[56] | 0.8% |

## TABLE 18

## Heterotropic ossification

| | |
|---|---|
| Our Study | 13% |

Kasetti RJ et al. (2001)[27] conducted an exclusive study of hetero tropic ossification following Total hip arthroplasty. The incidence in this study is.

**Total incidence – 67.2%.**

| **Brooker Class** | |
|---|---|
| I | 50.7% |
| II | 12.7% |
| III | 2.2% |
| IV | 1.5% |

In his study none of the patients had any recognized risk factors for Heterotropic Ossification and none of the patients had any pharmacological or radiotherapeutic prophylaxis against Heterotropic Ossification. He also noted negative correlation between the prevalence of Heterotropic Ossification and post operative Harris hip score . The incidence and severity of Heterotropic Ossification in anterolateral approach is found to be higher than the posterior approach. In Schreiner et al[55] study the incidence of Heterotropic Ossification is 5.7%.

**TABLE 19**

**Post operative anterior thighpain**

| | |
|---|---|
| Our Study | 8.6% |
| Schramm et al.[51] | 17% |
| Peter Aldinger et al. [52] | 0% |
| RB Bourne et al.[40] | 6% |

**TABLE 20**

**Sciatic Nerve Palsy**

| | |
|---|---|
| Our Study | 0% |
| Alexander et al. | 1% |

**TABLE 21**

**DVT / Pulmonary embolism / Pneumonia**

| | |
|---|---|
| Our Study | 0% |
| Alexander et al. [40] | |
| DVT | 1% |
| Pneumonia | 1% |
| Fatal pulmonary embolism | 0.4% |

# CONCLUSION

- Uncemented Total hip arthroplasty is mainly indicated in young patients with adequate bone stock.
- Careful patient selection along with preop and postop evaluation of both patients and radiographs is essential for the success of total hip arthroplasty .
- Failure of the patients to follow post op instructions regarding life style changes is one of the reason for fair to poor results in our study.
- In our study the results are fair to poor in non compliant young patients with high functional demands.
- The results are far better in young patients with low functional demands.
- The results are fair to poor in patients with bilateral affections like Rheumatoid arthritis and ankylosing spondylits with unilateral total hip arthroplasty.
- The dislocation rate is higher in large cups with over hanging margins in abnormal version and inclination.
- The complications like pneumonia, fatal pulmonary embolism, DVT, sciatic nerve palsy, Periprosthetic femoral stem fracture etc., or not seen in our study.
- In the preoperative and post operative assessment modified Harris hip score is very useful to evaluate the functional outcome.

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## PROFORMA FOR THE FUNCTIONAL ASSESSMENT OF UNCEMENTED TOTAL HIP ARTHROPLASTY

1. Name :
2. Age :
3. Sex :
4. Address :
5. Occupation :
6. Income :
7. Diagnosis :
8. Date of Surgery :
9. Number of Months elapsed since surgery :

**Other relevant data:**

1. Diabetes :
2. Hypertension :
3. Asthma :
4. Smoking
5. Alcoholism
6. Anemia :
7. Cardiac diseases :

8. Renal diseases :
9. Neurological disorders :
10. Tuberculosis :
11. Epilepsy :
12. Musculoskeletal Developmental disorders:
13. Chronic intake of drugs :
14. History of previous surgeries :
15. Associated opposite hip pathology :

**Operative and Post operative details:**

1. Surgical approach :
2. Implant used :
3. Post-op complications :
    a. Anterior Thigh pain :
    b. Nerve palsy – Scitiac :
    c. Vascular injury :
    d. Thrombo-embolism :
    e. Haematoma formation :
    f. Urinary tract infection :
    g. Femoral fractures :
    h. Subluxation and dislocation :
    i. Infection
        1. Acute post op-first 12 weeks :
        2. Deep delayed – 6 to 24 months :
        3. Late heamatogenous – more than 2 years

**Radiological Evalution:**

**Acetabular component:**

1. Correct size :
2. Correct Seating with out any polar gaps :
3. 45° Inclination at tear drop level :
4. Correct version :
5. Restoration of center of rotation :
6. Tip of greater trochanter to center of head:
7. Polyethylene wear :
8. Position of trans acetabular screws :
9. Loosening :
10. Acetabular fracture :
11. pelvic osteolysis :
12. protrusion of cup :
13. Rein forcement with cages, rings, impaction grafting
14. Any revision of cup :

**Femoral component:**

1. Optimal position :
2. Neutral tip of stem :
3. Level of lesser trochanter :
4. Restoration of medial offset :
5. Restoration of vertical offset :
6. Correct seating of collar on neck :
7. Fixation by – :

Bony in growth :

Stable fibrous in growth :

Unstable implant :

8. Loosening :

9. Bentstem :

10. Peri prosthetic fracture :

11. Post of dislocation :

12. Femoral fracture :

13. Heterotropic ossification :

14. Trochanteric non union or migration :

15. Revision of stem :

**FUNCTIONAL ASSESSMENT :**

**Modified Harris Hip Score**

| **1. Pain** | | **Pre-Op** | **Post -Op** |
|---|---|---|---|
| Totally disabled Crippled pain in bed, bedridden | 0 | | |
| Marked pain, serious limitation of activities | 10 | | |
| Moderate pain, tolerable but makes concessions to pain.Some limitations of ordinary activity or work. May require occasional pain medication stronger than aspirin. | 20 | | |
| Mild pain, no effect on average activities, Rarely moderate pain with unusual activity, may take aspirin | 30 | | |
| Slight, occasional, no compromise in activity | 40 | | |
| None, or ignores it | 44 | | |
| **2. Limp** | | **Pre-op** | **Post-op** |
| Severe | 0 | | |
| Moderate | 5 | | |
| Slight | 8 | | |

| | | | |
|---|---|---|---|
| None | 11 | | |
| **3. Support** | | **Pre-op** | **Post-op** |
| Two crutches or not able to walk | 0 | | |
| Two canes | 2 | | |
| One crutch | 3 | | |
| Cane Most of the time | 5 | | |
| Cane for long walks | 7 | | |
| None | 11 | | |
| **4. Distance Walked** | | **Pre-op** | **Post-op** |
| Bed and chair | 0 | | |
| Indoor only | 2 | | |
| 2 or 3 blocks (250 to 375 mts) | 5 | | |
| 6 blocks walking (750 mts) | 8 | | |
| Unlimited | 11 | | |
| **5. Stairs** | | **Pre-op** | **Post-op** |
| Unable to do stairs | 0 | | |
| In any manner | 1 | | |
| Normally using a railing | 2 | | |
| Normally without using a railing | 4 | | |
| **6. Put on shoes or socks** | | **Pre-op** | **Post-op** |
| Unable | 0 | | |
| With difficulty | 2 | | |
| With ease | 4 | | |
| **7. Sitting** | | **Pre-op** | **Post-op** |
| Unable to sit comfortably on any chair | 0 | | |
| On a high chair for 30 minutes | 3 | | |
| Comfortably, ordinary chair for one hour | 5 | | |

| **8. Enter public transportation** | | **Pre-op** | **Post-op** |
|---|---|---|---|
| Yes | 1 | | |
| No | 0 | | |
| **9. Flexion contracture – degrees** | | | |
| **10. Limb Length discrepancies - cms** | | | |
| **11.Absence of deformities –All yes- 4 less than**4-0 | | | |
| Less than 30 degrees FFD | | | |
| Less than 10 degrees Fixed Adduction | | | |
| Less than 10 degrees Fixed internal rotation in Extension | | | |
| LLD less than 3.2 cms | | | |
| **12. Range of Motion** | | | |
| Flexion – 140 – | | | |
| Abduction – 40 - | | | |
| Adduction – 40 - | | | |
| ER – 40 - | | | |
| IR – 40 - | | | |
| **Total Score** | | | |
| **Range of motion scale** | | | |
| 0-30 degree | 0 | | |
| 31 to 60 degrees | 1 | | |
| 61 to 100 degrees | 2 | | |
| 101 to 160 degrees | 3 | | |
| 161 to 210 degrees | 4 | | |
| 211 to 300 degrees | 5 | | |
| **Range of motion score** | | | |
| **Total Harris Hip Score** | | | |

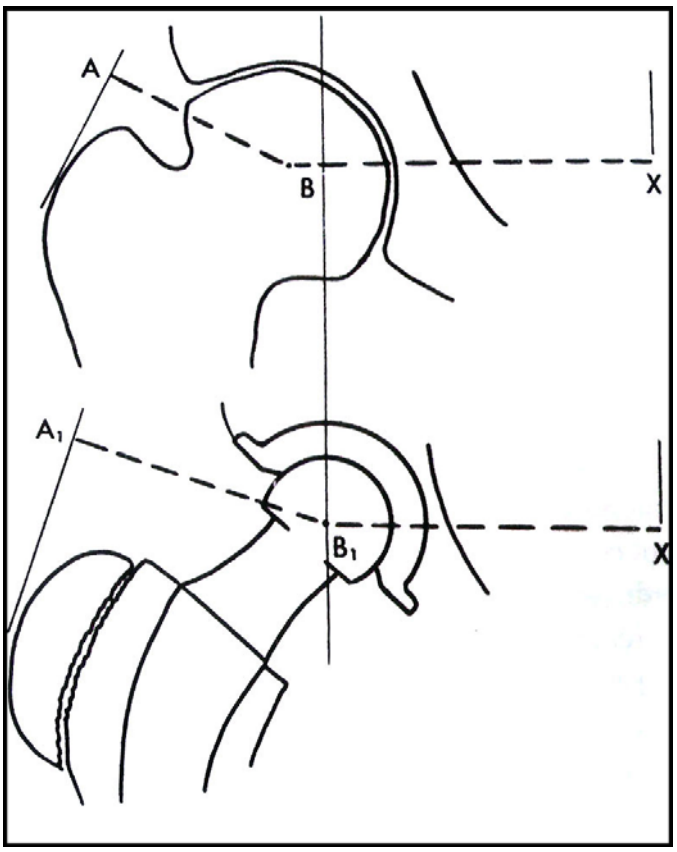
# MASTER CHART

| Sl No. | Name | Age | Sex | Diagnosis | DOS | FU Period as on1/7/05 | IMPLANT USED | | RADIOLOGICAL ASSESSMENT (ACETABUAR COMP) | |
|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | ACETABULAR CUP | FEMORAL STEM | OPTIMAL POSITION | LOOSENING ZONE |
| 1 | Ravichandran | 31 | M | AVN (R) hip | 24.1.01 | 53 Mons | Standard | CLS | Yes | – |
| 2 | Baskar | 43 | M | # Non union NOF (R) | 2.2. 01 | 53 Mons | St. Nabor | CLS | No | – |
| 3 | Vetrivel | 21 | M | # Non union NOF (R) | 16.2. 01 | 52 Mons | Standard | CLS | Yes | – |
| 4 | Jebaraj | 30 | M | Chronic arthritis (L) | 4.5. 01 | 50 Mons | Standard | CLS | Yes | – |
| 5 | Vijayasundaram | 37 | M | Chronic arthritis (R) | 25.5. 01 | 49 Mons | Standard | CLS | Yes | – |
| 6 | Vijayasundaram | 37 | M | Chronic arthritis (L) | 29.6. 01 | 48 Mons | Standard | CLS | Yes | – |
| 7 | Palaniammal | 42 | F | Chronic arthritis (L) | 3.8. 01 | 47 Mons | St. Nabor | CLS | Yes | – |
| 8 | Tajunisha | 24 | F | RA (L) Hip | 24.9. 01 | 45 Mons | Standard | CLS | Yes | – |
| 9 | Jeganathan | 30 | M | Chronic arthritis (L) | 28.9. 01 | 45 Mons | Standard | CLS | Yes | – |
| 10 | Naseema | 40 | F | Chronic arthritis (R) | 22.10.01 | 44 Mons | Standard | CLS | Yes | – |
| 11 | Kasinath | 30 | M | Chronic arthritis (L) | 29.10.01 | 44 Mons | Standard | CLS | Yes | – |
| 12 | Leela | 27 | F | Chronic arthritis (L) | 27.12.02 | 30 Mons | Standard | CLS | No | – |
| 13 | Govindaraj | 45 | M | Ankylosing Spondylitis (R) | 27.2.03 | 28 Mons | Standard | CLS | No | – |
| 14 | Raghupathy | 45 | M | AVN (L) Hip | 4.3.03 | 28 Mons | Standard | CLS | Yes | 2,3 |
| 15 | Chandrasekharan | 40 | M | AVN (R) hip | 2.4.03 | 27 Mons | Standard | CLS | Yes | 1,2,3 |
| 16 | Ellammal | 40 | F | Chronic arthritis (L) | 13.6.03 | 24 Mons | Standard | CLS | Yes | – |
| 17 | Kumara pooshanam | 40 | F | Fracture neck of femur with Implant failure (L) | 2.7.03 | 24 Mons | Standard | CLS | No | – |
| 18 | Amresh | 29 | M | AVN (R) hip | 16.7.03 | 24 Mons | Standard | CLS | Yes | - |
| 19 | Amresh | 29 | M | AVN (L) hip | 2.8.03 | 23 Mons | Standard | CLS | Yes | - |
| 20 | Raja | 27 | M | Neglected Post dislocation (R) hip | 9.12.03 | 19 Mons | Standard | CLS | Yes | – |
| 21 | Annamalai | 29 | M | Ankylosing Spondylitis (R) hip | 7.1.04 | 18 Mons | Standard | CLS | Yes | – |
| 22 | Ramamoorthy | 50 | M | Non union # NOF (L) | 4.2.04 | 17 Mons | St Nabor | CLS | Yes | – |
| 23 | Valliammal | 60 | F | # Neck of femur (L) with implant failure | 6.2.04 | 17 Mons | St Nabor | CLS | Yes | – |

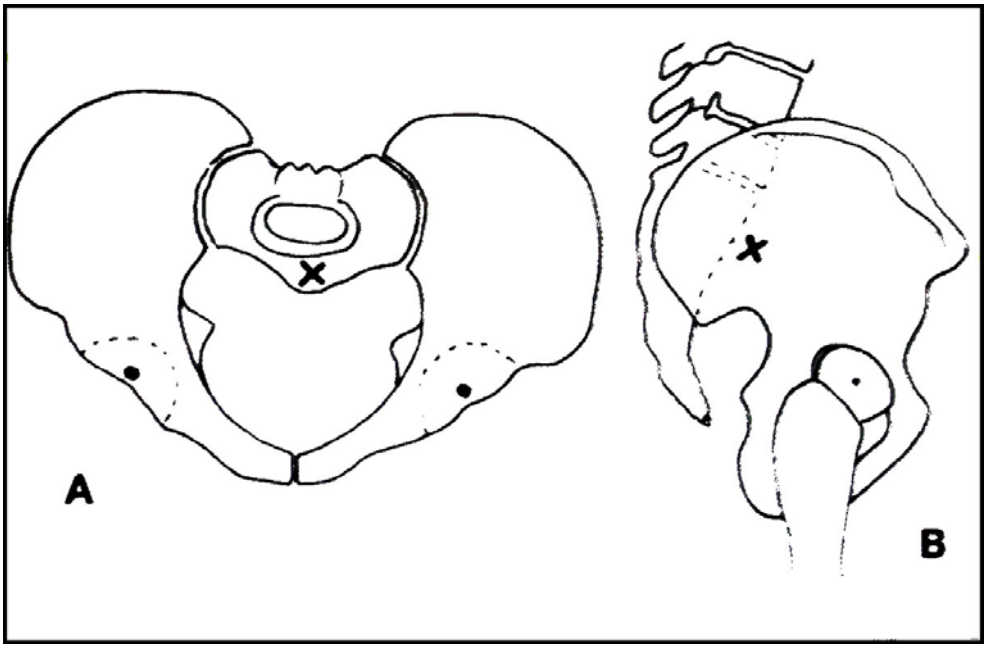
| S. No. | Name | Radiological assessment (Femoral stem) | | Complications | Limb length discrepancy | Functional Assessment | | Functional Outcome |
|---|---|---|---|---|---|---|---|---|
| | | Optimal position | Loosening Zones | | | Preop Harris hip score | Post op Harris hip score | |
| 1. | Ravichandran | Neutral | - | - | - | 46 | 88 | Good |
| 2. | Baskar | Neutral | - | Protrusio, pelvic osteolysis, intra op femoral fracture | - | 37 | 77 | Fair |
| 3. | Vetrivel | Neutral | - | - | - | 42 | 85 | Good |
| 4. | Jebaraj | Valgus | - | Protrusio, Heterotropic ossification | 1 cm | 53 | 79 | Fair |
| 5. | Vijaya Sundaram (R) | Neutral | - | - | - | 46 | 82 | Good |
| 6. | Vijaya Sundaram (L) | Neutral | - | - | - | 46 | 84 | Good |
| 7. | Palaniammal | Neutral | - | - | - | 54 | 93 | Excellent |
| 8. | Tajunisha | Valgus | - | Intraopfemoral fracture hetero tropic ossification | - | 48 | 95 | Excellent |
| 9. | Jaganathan | Neutral | - | Anterior thigh pain | 1 cm | 37 | 87 | Good |
| 10. | Naseema | Neutral | - | - | 1 cm | 45 | 92 | Excellent |
| 11. | Kasinath | Neutral | - | - | - | 32 | 84 | Good |
| 12. | Leela | Neutral | - | - | - | 42 | 86 | Good |
| 13. | Govindaraj | Valgus | - | - | 1 cm | 53 | 72 | Fair |
| 14. | Raghupathy | Neutral | - | Pelvic osteolysis | - | 31 | 84 | Good |
| 15. | Chandrasekar | Varus | 4, 5, 6, 7 | Anterior thigh pain | 1 cm | 55 | 68 | Poor |
| 16. | Ellammal | Neutral | - | - | - | 49 | 83 | Good |
| 17. | Kumarapoosha nam | Neutral | - | Trochanteric esteolysis | - | 47 | 92 | Excellent |
| 18. | Amresh (R) | Neutral | - | - | - | 52 | 82 | Good |
| 19. | Amresh (L) | Neutral | - | - | - | 52 | 82 | Good |
| 20. | Raja | Neutral | - | Post op dislocation, wound infection,acetabular revision | 2 cm | 38 | 72 | Fair |
| 21. | Annamalai | Varus | - | Hetero tropic ossification | - | 54 | 76 | Fair |
| 22. | Ramamoorthy | Neutral | - | Pelvic osteolysis | - | 43 | 91 | Excellent |
| 23. | Valliammal | Neutral | - | Protrusio, intra op acetabular fracture | 1 cm | 48 | 72 | Fair |

Between 9-10

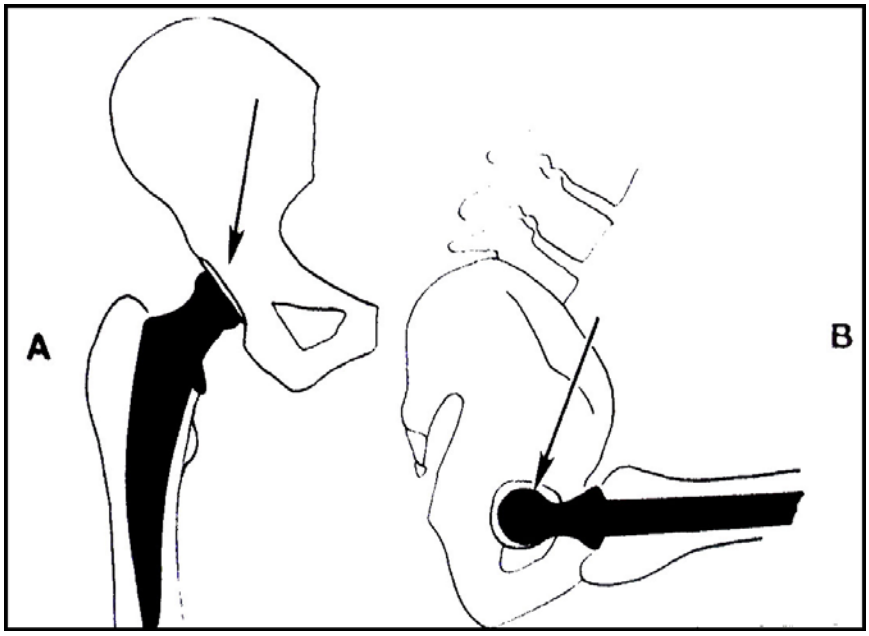
## LEVER ARMS ACTING ON HIP JOINT



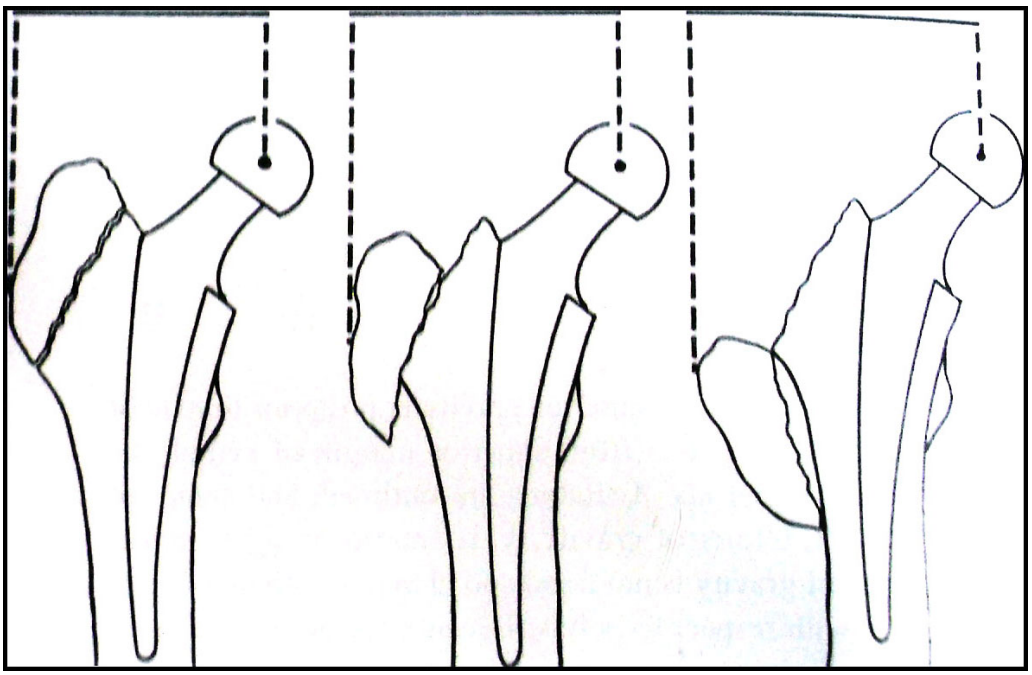

## AXIS OF HIP JOINT WITH CENTRE OF GRAVITY



## FORCES PRODUCING TORSION OF STEM

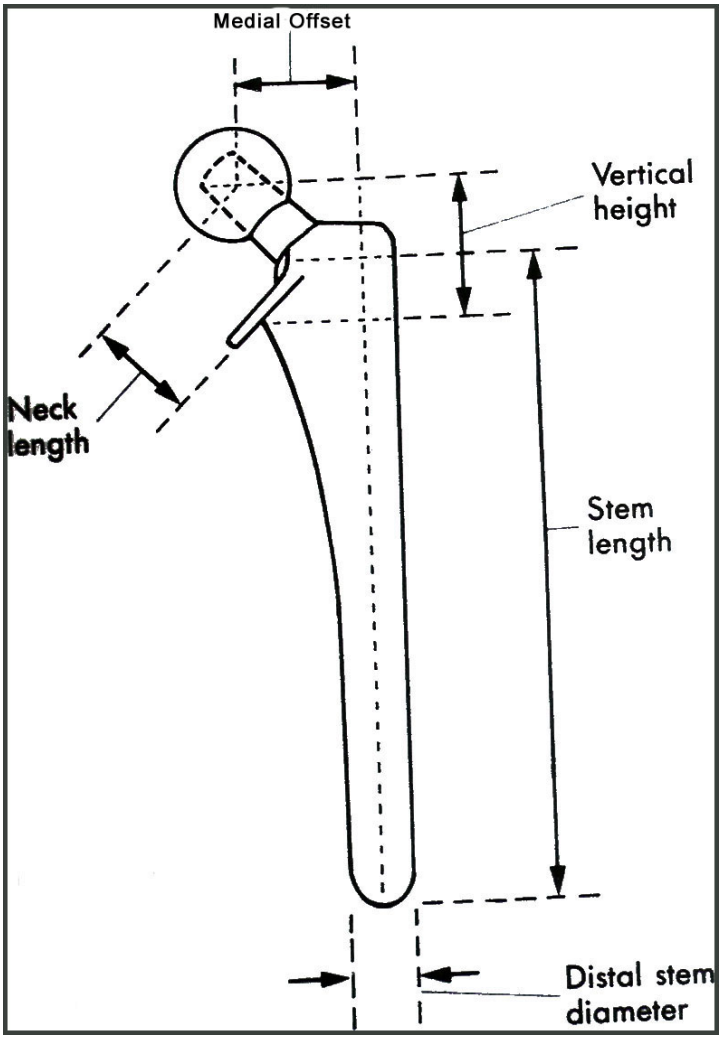



## LENGTHENING OF LEVER ARM OF ABDUCTORS



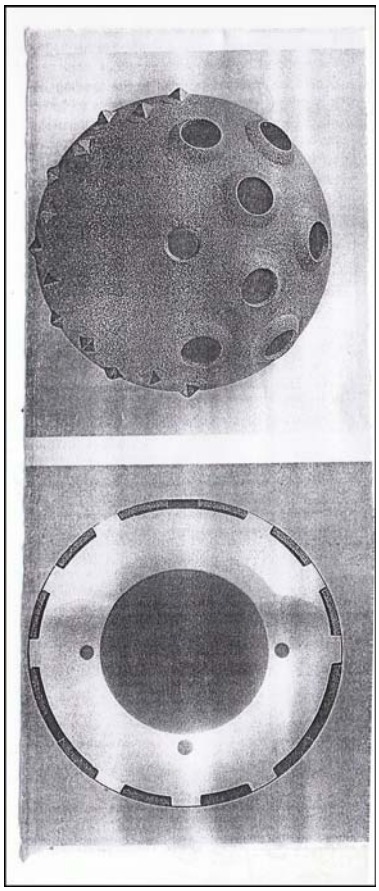
Between 12-13

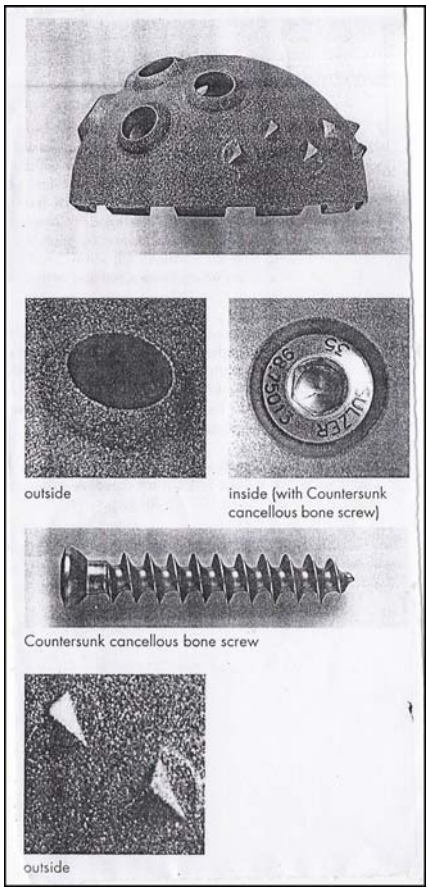
# FEATURES OF FEMORAL COMPONENT

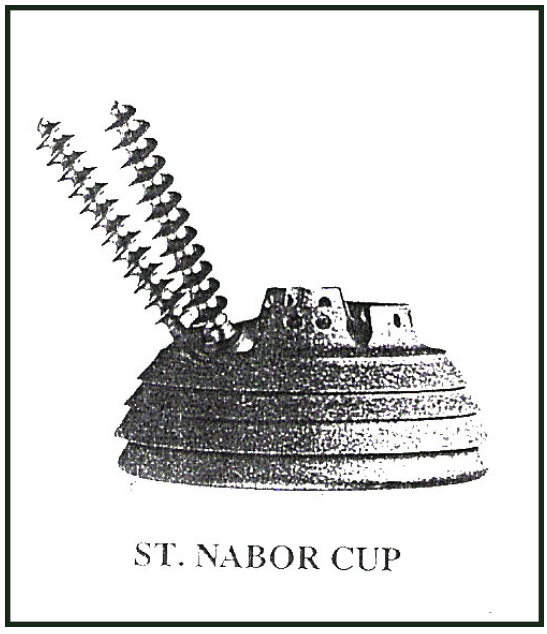


Between 18-19

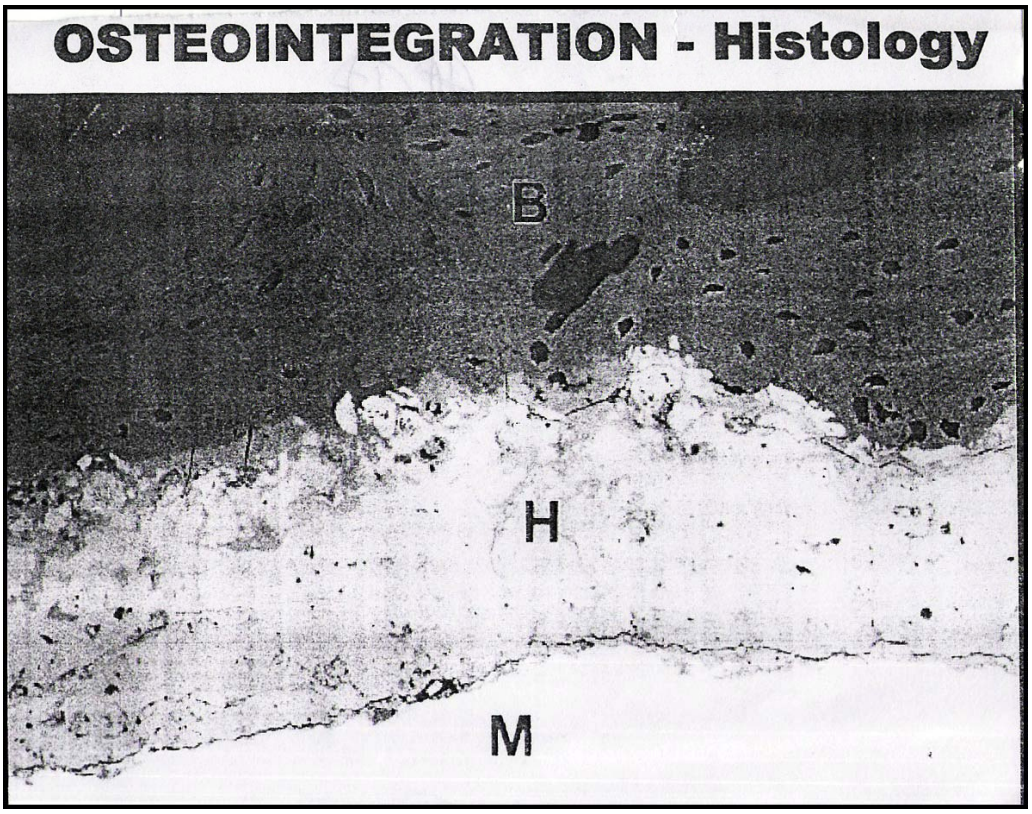
# STANDARD CUP



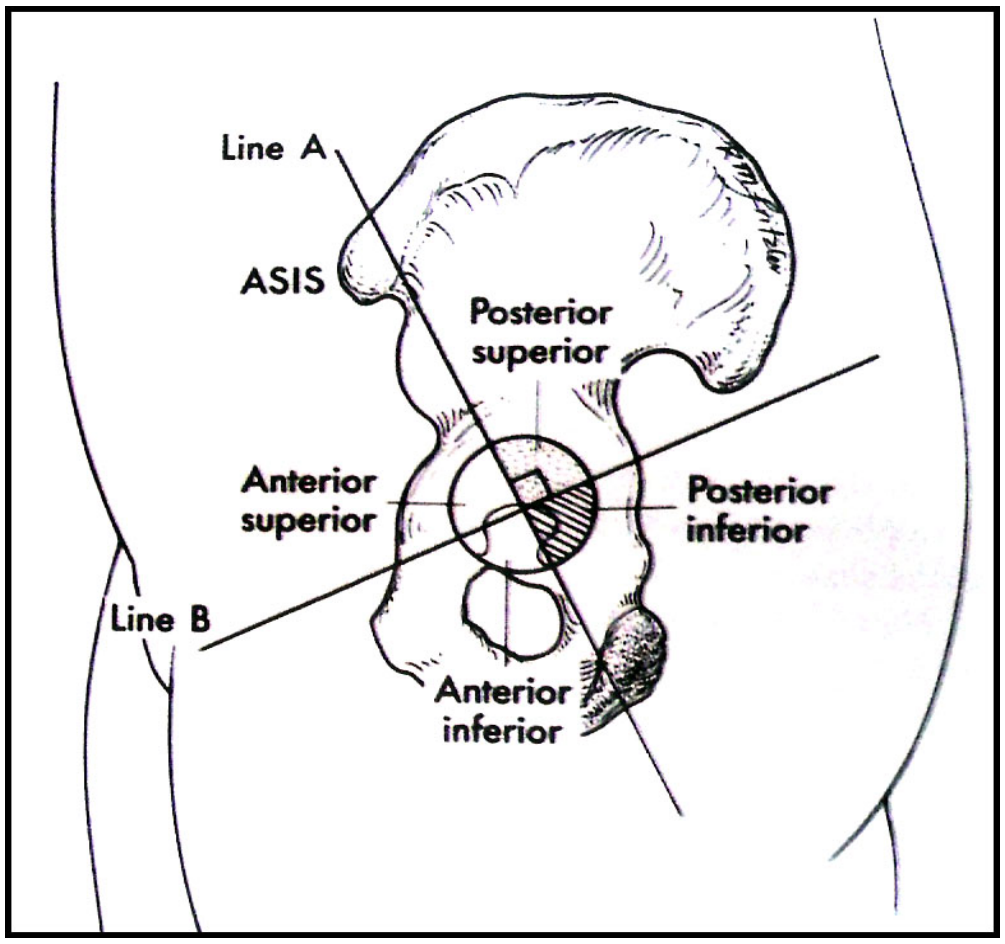


**Between 20-21**



# ACETABULAR QUADRANT SYSTEM BY WASIE LEWSKIE et al.



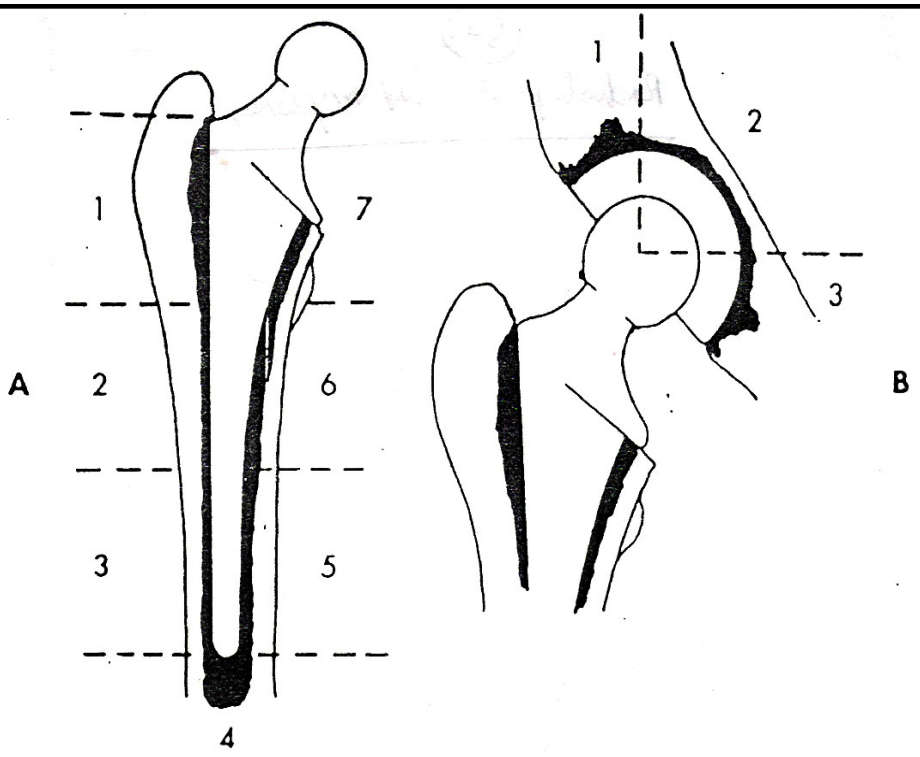
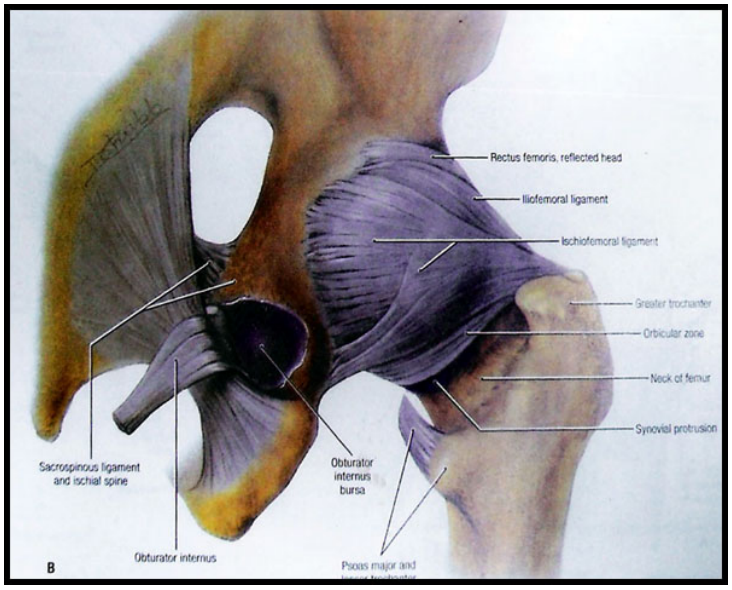


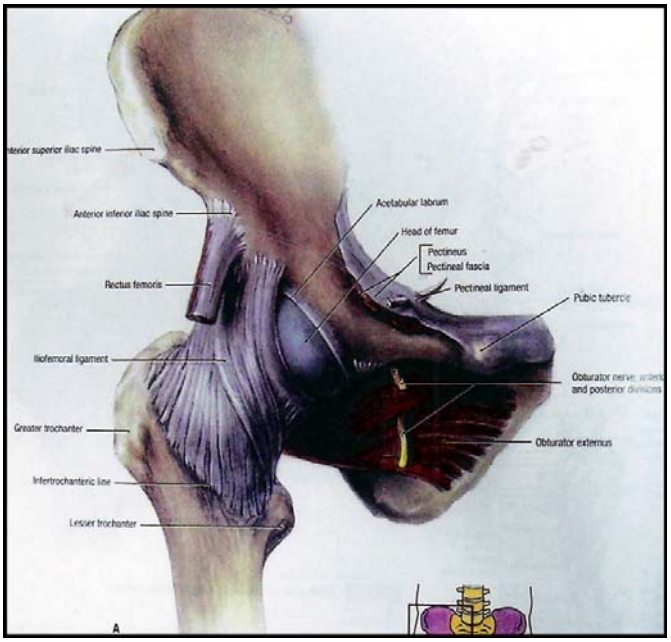

*Fig. 7-141* Zones about cement mass in femur (A) as described by Gruen and in pelvis (B) as described by DeLee and Charnley. (Redrawn from Amstutz HC, Smith RK: *J Bone Joint Surg* 61-A:1161, 1979.)

# SURGICAL ANATOMY OF HIP JOINT

## ANTERIOR ASPECT

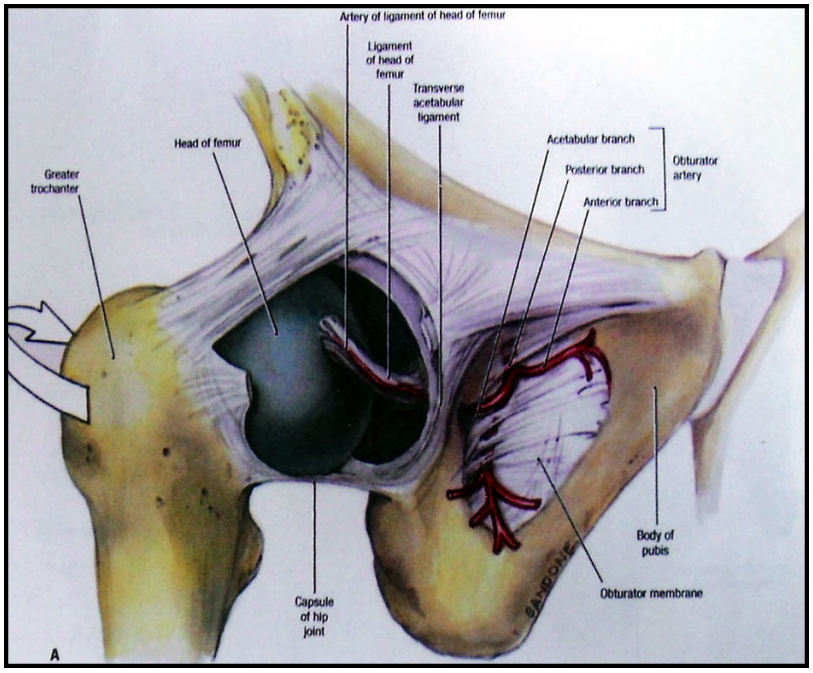



## POSTERIOR ASPECT

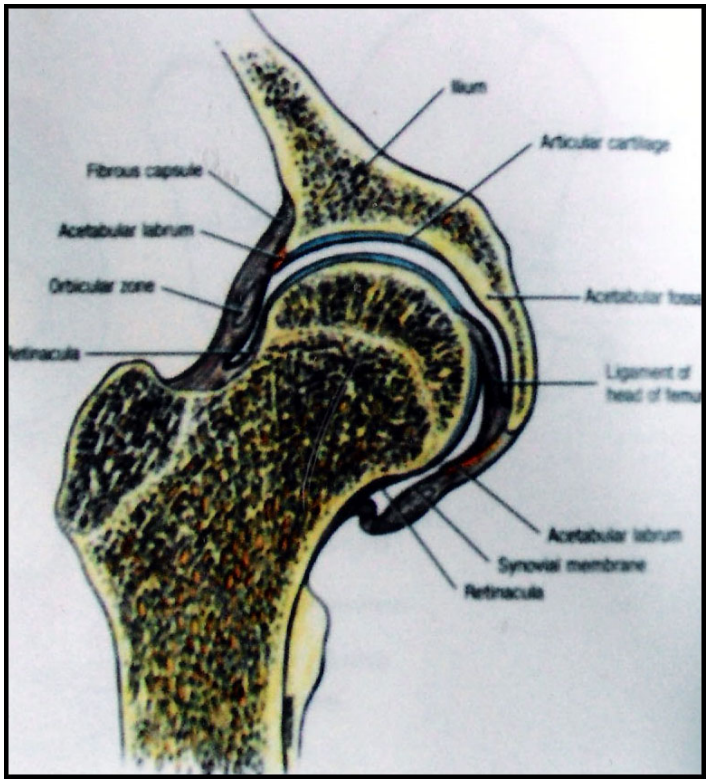


Between 7-8

# CAPSULAR EXPOSURE

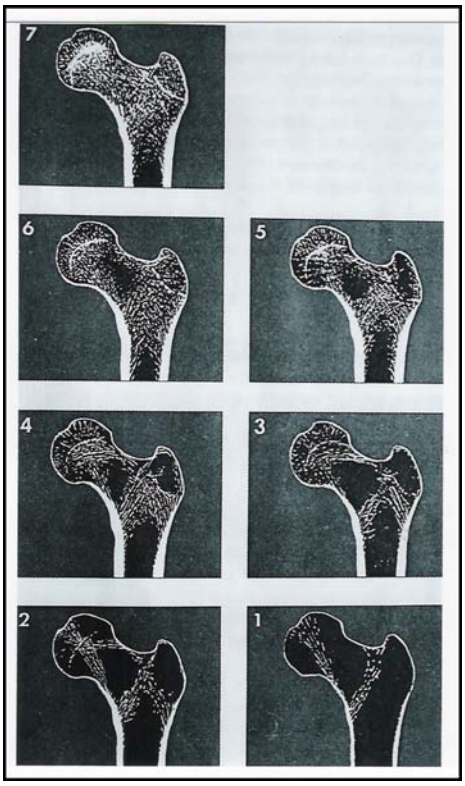



## HIP JOINT AND CAPSULE – CUT SECTION

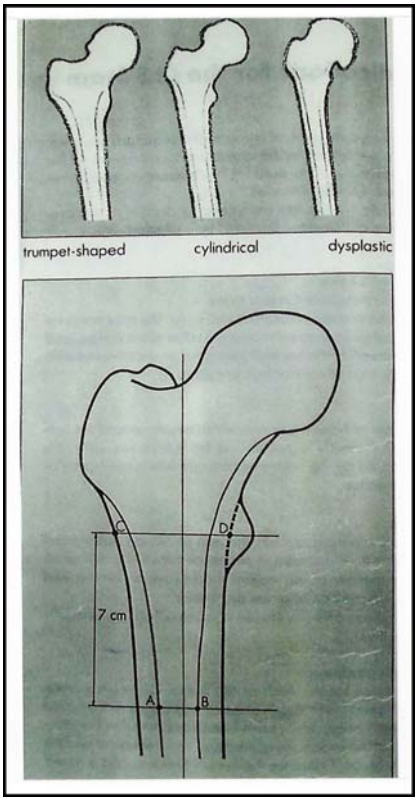



Between 14-15

# SINGH'S INDEX OF OSTEOPOROSIS



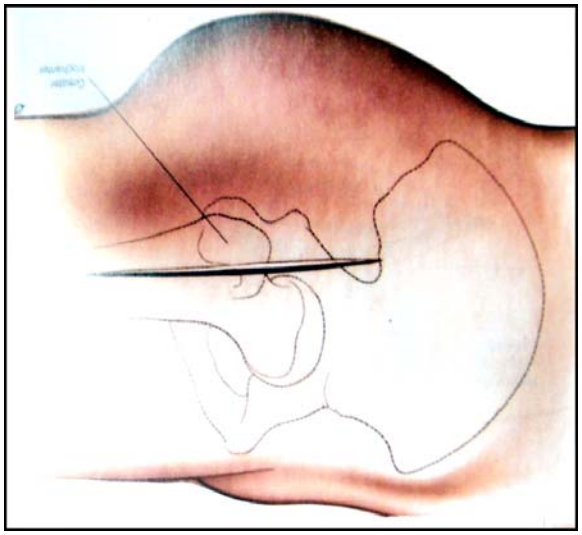

**MORPHOLOGICAL - CORTICAL INDEX**

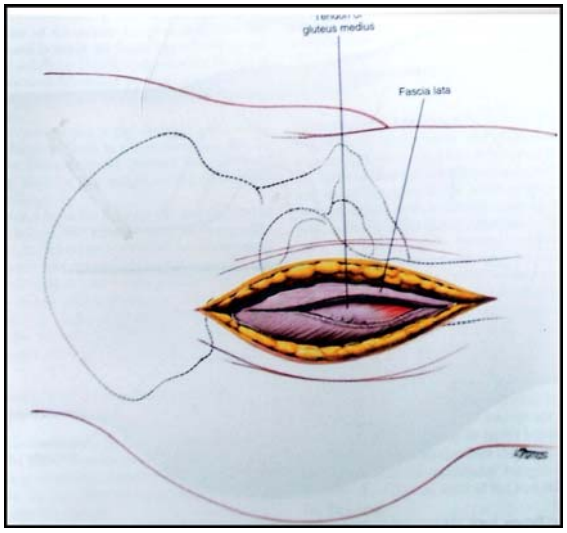


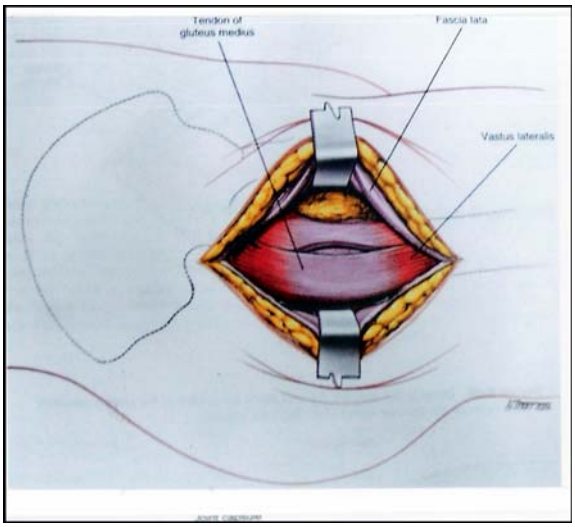

Between 16-17

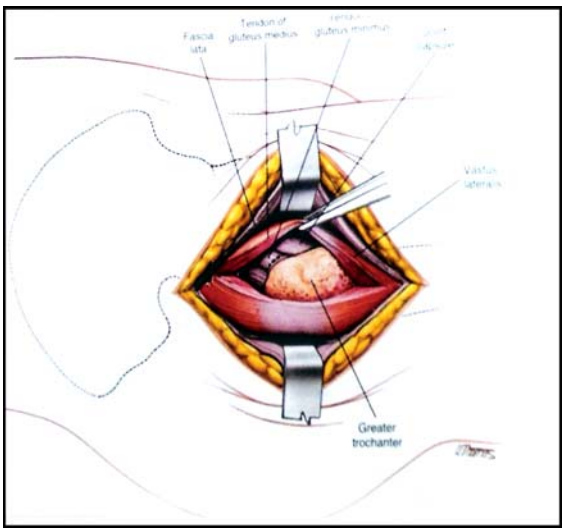
# CLS STEM

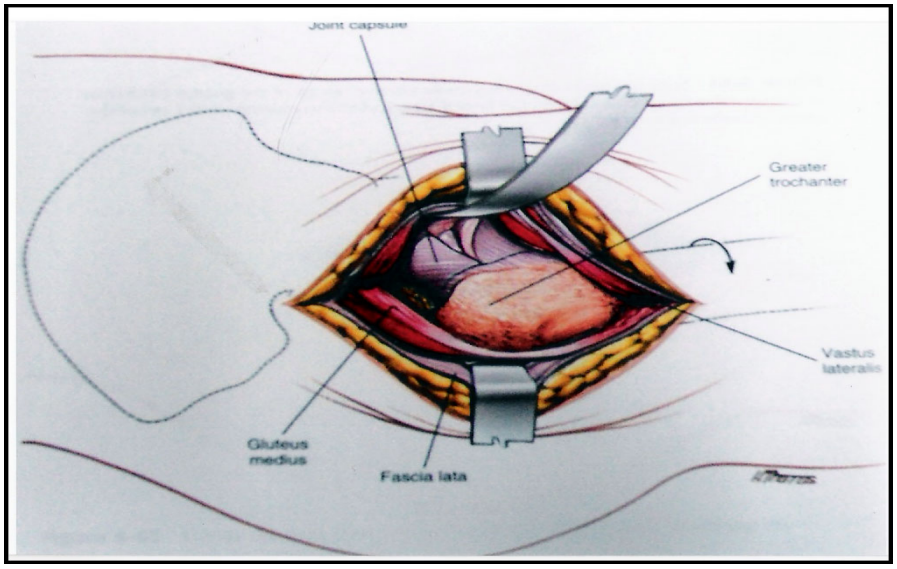
# HARDINGE LATERAL APPROACH

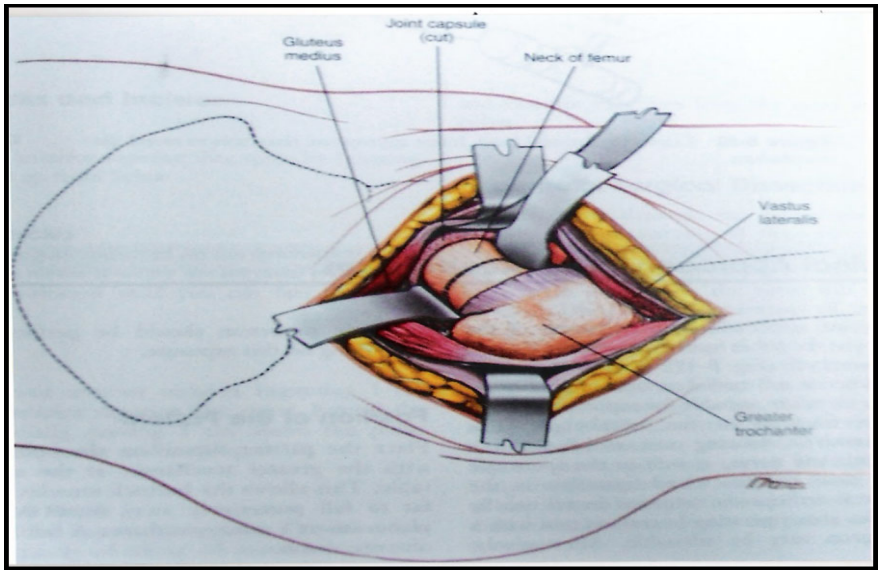


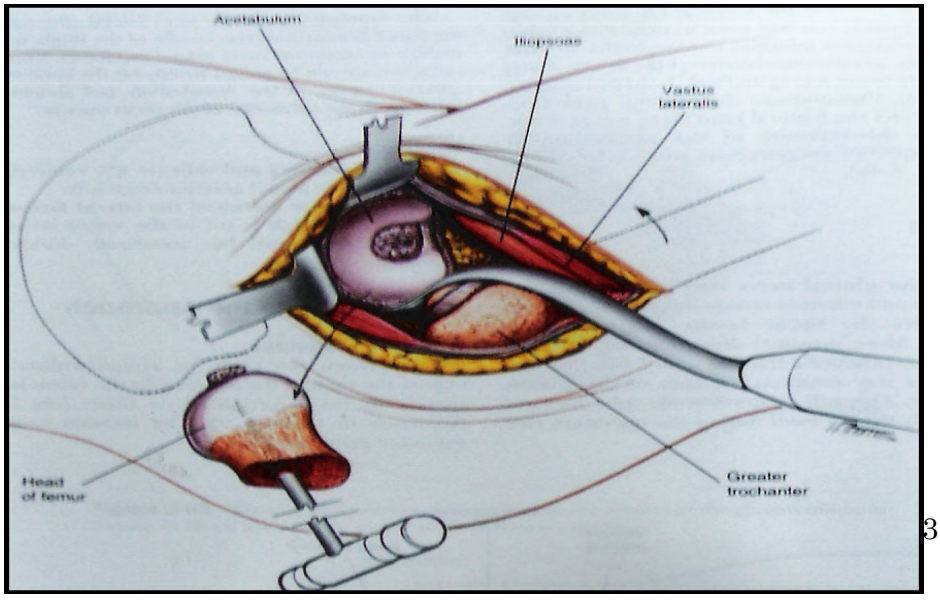


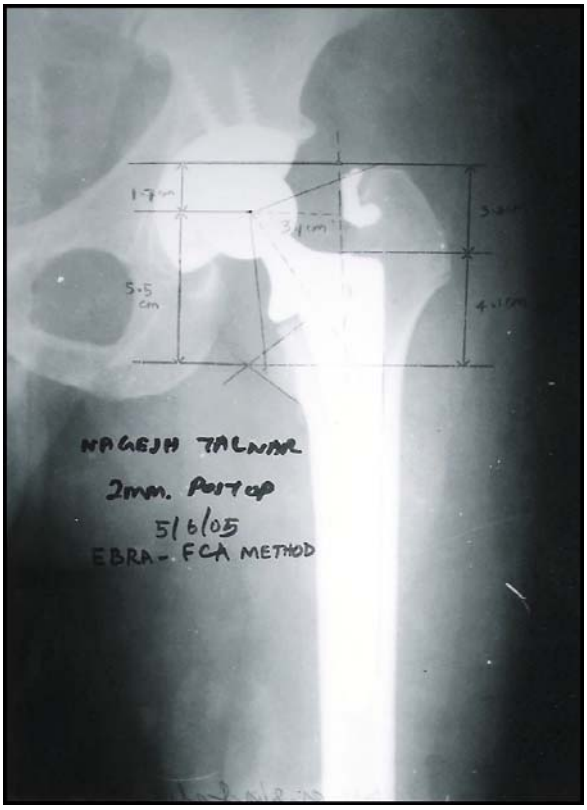

Joint capsule
Greater trochanter
Vastus lateralis
Gluteus medius
Fascia lata

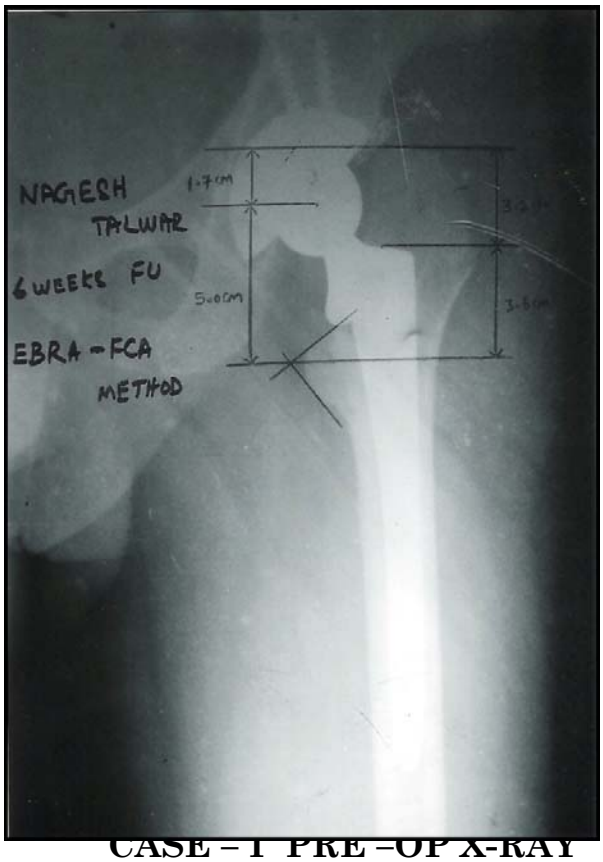

Gluteus medius
Joint capsule (cut)
Neck of femur
Vastus lateralis
Greater trochanter


Acetabulum
Iliopsoas
Vastus lateralis
Head of femur
Greater trochanter

38-39

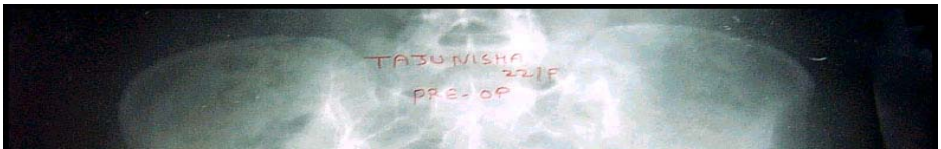
**EBRA – FCA METHOD OF MEASUREMENT OF MIGRATION OF FEMORAL STEM**



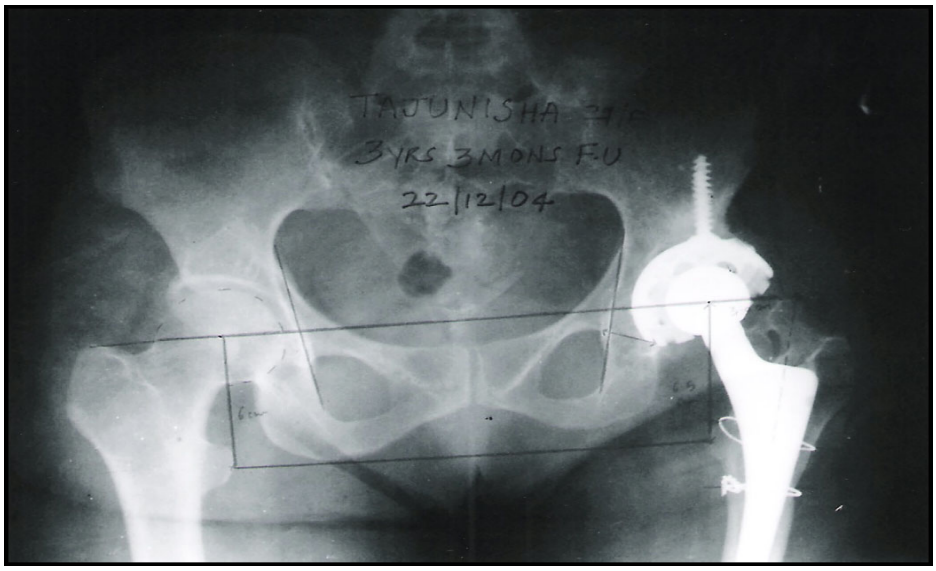




Between 60-61

**CASE – 1 PRE –OP X-RAY**



## POST OP X-RAY


TAJUNISHA
3YRS 3MONS F.U
22/12/04

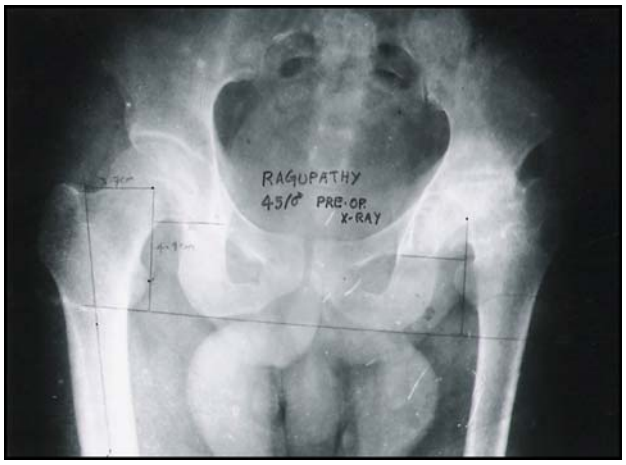

TAJUNISHA 27/F
3YRS 3MONS F.U
22/12/04

# CASE I

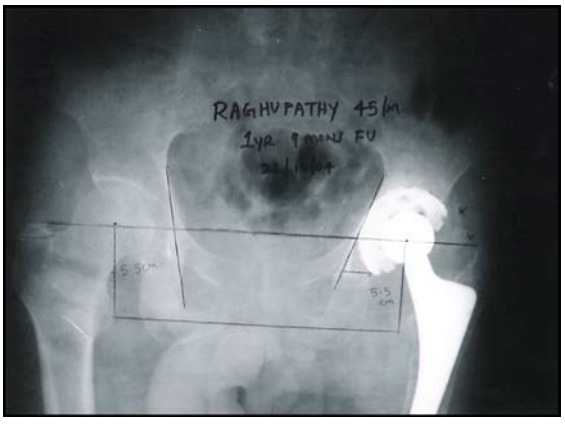
## CLINICAL ILLUSTRATION


# CASE 2

## Pre op




## Post op




# CLINICAL ILLUSTRATION

# COMPLICATIONS

**Large cup with overhanging margins.**


**Femoral loosening, acetabular loosening,**
**trochanteric osteolysis**


**Intra op femoral fracture & Heterotropic ossification**


**Acetabular fracture with impaction grafting**

**Protrusion of the cup**